

Studies on seasonal variations in physico-chemical parameters of the Temple pond Nashik District (M.S.), India.

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Abstract

Present work focused on the seasonal variations in the physico-chemical parameters of the freshwater temple pond-Prayagirth at Trimbakeshwar in Nashik district during summer, monsoon and winter. A total 15 parameters were analysed and their seasonal variation is discussed. The correlation matrix of the various physico-chemical parameters are computed and analysed.

Keywords: Physico-chemical Parameters, Nashik, temple pond.

INTRODUCTION

Temples are centers of worship for Hindus and Sikhs. Hindu temples have in their vicinity certain ponds which are holy and called temple ponds. Ponds are found inside the temples or outside the temples. Temple management imposes restrictions over misuse of these holy ponds, therefore they remain comparatively clean. Temple devotees use the holy water for washing their limbs, sometimes they make a holy dip into the water and people believe that it can wash all their sins away [11]. There is a relationship among ecologists and microplanners about the importance of conservation of ponds as sustainable source of water for rural communities [4].

The present study is an attempt to assess the water quality of pond in a rural area of Nashik district so that it may be sustainably exploited for multiple uses like rural water supply, fisheries and even recreation.

MATERIAL AND METHOD

For the study of physico-chemical analysis water samples were collected fortnightly from the pond surface in a clean polythin container for the period of one year, February 2010 to January 2011. Water samples were collected during morning hours in between 8.00 to 10.00 a.m. with one litre containers from the three sites of the pond. To study the water quality and its seasonal variations, the water samples were collected during summer (February to May 2010), monsoon (June to September 2010) and winter (October to January 2011). Some of the results were recorded at the sampling sites whereas the others were recorded in the laboratory. The parameters observed were colour, pH, hardness, calcium, magnesium, turbidity, sulphate, phosphate, DO, free CO₂, alkalinity,

chloride, gross and net primary productivity and BOD. The colour of temple pond water was observed visually. The various physico-chemical parameters were analysed by following the standard methods of Trivedy and Goel [17], APHA [1]. Primary productivity was measured using dark and light bottle method and turbidity was measured by Secchi Disc method. Fortnightly data obtained were compiled to get the seasonal mean, standard deviation, correlation matrix.

Study Area: Prayagirth Pond

It is situated two kilometer away from Trimbakeshwar city, which is 24 km away from Nashik district. It lies at 19°94'55" north latitude and 73° 55'10" east longitude. This pond is stagnant, perennial and hexagonal in shape. It measures about 1.5acre, 20 meter deep and well constructed. Three sites were selected of which site I and site III are in the line with human disturbances, domestic animals, whereas site II is less disturbed. The pond serves as water reservoir for agriculture, washing clothes and for drinking and washing domestic animals.

RESULTS AND DISCUSSION

The quantitative analysis of various physico-chemical parameters are presented in Table I. The water temperature varied with variation of season as lowest in winter and highest in monsoon, this result is supported by the findings of Lashari *et al.*, [8]. The lowest pH value was found during winter due to heavy rainfall and dilution effect by Shiddamallayya and Pratima [14], Agarkar and Garode [3]. The alkaline pH was also recorded throughout the year by Mali and Gajaria [9]. Dissolved oxygen was recorded minimum in winter Venkatesharaju *et al.*, [18] and highest in monsoon may be due to the low solubility at high temperature and high degradation of organic substances put forth by Rajagopal *et al.*, [19]. The lowest amount of free carbon-dioxide is recorded in monsoon and highest in summer due to the decomposition of organic matter is fast during summer whereas it is low during monsoon by Raj Narayan *et al.*, [10]. The Secchi disc transparency (turbidity) shows that water is more turbid in monsoon and least turbid in winter, this finding is supported by Kedar *et al.*, [6]. In monsoon months the flushing of water from the catchment area were increases the turbulence and suspension of

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particles, whereas in winter the settlement of silt, clay and heavy suspended particles result in least turbidity in winter. Hardness measures highest in summer and lowest in winter, Kaur and Sharma was reported maximum hardness in summer [7]. The increase in hardness can be attributed to the decrease in water volume and increase in the rate of evaporation at high temperature, high loading organic substances, detergents, chlorides and other pollutants by Rajagopal *et al.*, [19]. The highest value of calcium was recorded in summer. The maximum concentration of magnesium was recorded in summer and minimum in winter (Fig.1).

Net primary productivity was noticed maximum in summer and minimum in monsoon. Gross primary productivity was found maximum in monsoon and minimum in winter, this result is supported by the findings of Dike *et al.*, [5]. The minimum BOD was noticed during the winter due to decrease in temperature which leads to decrease in microbial activity and algal blooms by Sachidanandamurthy and Yajurvedi [12], Shiddamallayya and Pratima [14]. The highest BOD was recorded during summer due to high temperature favors microbial activity, this result is supported by Sachidanandamurthy and Yajurvedi [13], Shinde *et al.*, [16]. The lowest concentration of chloride was observed in summer and highest in monsoon. The low concentration of chloride was observed in summer by some other workers like Shiddamallayya and Pratima [14], Venkatesharaju *et al.*, [18].

The lowest alkalinity was observed during winter and highest during summer due to the decomposition of organic matter in water body, Shiddamallayya and Pratima [14] reported lowest alkalinity during winter. The lowest concentration of phosphate was assessed

during winter and highest during monsoon, might be due to rain water came from agricultural fields and mixed with the influent water of the reservoir, this result is supported by Shinde *et al.*, [15]. The highest content of sulphate was recorded during summer, the high value might be due to low water level during summer supported by Agarkar and Garode [2], Shinde *et al.*, [15]

The statistical analysis of the Pearson's correlation coefficient is presented in table II. The study of correlation coefficient of various physico-chemical parameters shows that they are related with each other. The increase in pH is positively correlated with hardness, magnesium, alkalinity, BOD, NPP and with sulphate. The temperature is positively correlated with D.O. gross primary productivity and phosphate and negatively correlated with turbidity, this result is supported by Sachidanandamurthy and Yajurvedi [13]. The increase in turbidity causes decrease in dissolved oxygen, gross primary productivity and phosphate concentration. Alkalinity enhances the decomposition of organic matter, which inturn increases the concentration of sulphate and BOD by Shiddamallayya and Pratima [14]. The increase in magnesium shows significant positive correlation with hardness, NPP, BOD and alkalinity.

The increase in carbon-dioxide shows decrease in GPP and chloride. Dissolved oxygen shows positive correlation with phosphate and sulphate. The increase in NPP shows significant positive change in alkalinity, sulphate and BOD. GPP shows positive correlation with phosphate. Increase in sulphate concentration shows increase in BOD. Hardness shows significant positive correlation with magnesium, NPP, alkalinity and BOD.

Table I. Seasonal Physico-chemical parameters (mean (mg/l) ± standard deviation) of Pond Prayagirth (February 2010 to January 2011).

Parameters	Summer	Monsoon	Winter
pH	8.837±0.33	8.72 ±0.49	8.485±0.19
Temp	21.83±5.51	25.52±1.34	20.07±4.3
Turbidity	39 ±10.55	20.25 ±2.06	52.5 ±6.45
Hardness	134.47±27.88	119.95±19.07	105.67±11.54
Calcium	30.25±5.82	22.047±5.11	23.79±1.28
Magnesium	68.29±6.5	59.54±9.65	49.697±6.3
Co ₂	40.08±10.43	23.28±9.68	35.38±5.44
D.O.	8.385±1.44	8.79±2.9	7.66±1.6
N.P.P.	2.045±0.30	1.99±0.99	1.877±0.30
G.P.P	1.32±0.13	1.657±0.24	1.28±0.13
Alkalinity	249.26±21.21	229.47±53.21	174.23±63.03
Chloride	76±13.12	173.48±35.41	127.71±28.1
Po ₄	0.483±0.16	0.54±0.16	0.432±0.05
So ₄	43.71±15.29	42.87±14.74	28.7±5.66
BOD	2.31±0.63	2.09±0.40	1.98±0.68

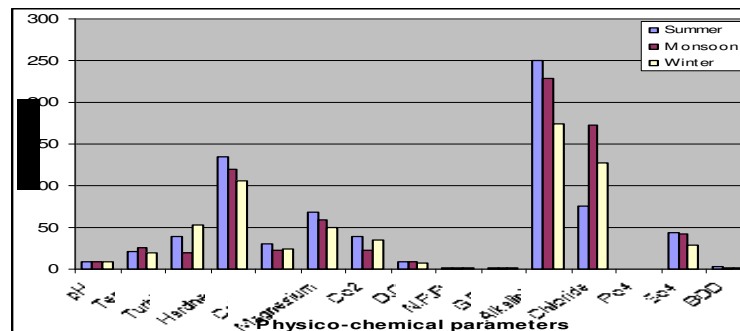


Fig 1. The seasonal representation of Physico-chemical parameters 2010-2011.

Table II. Correlation Matrix of Various Physico-Chemical Parameters at The Temple pond Prayagirth During February 2010 to January 2011.

	pH	Temp	Turb	Hard	Cal.	Mag.	CO ₂	D.O.	N.P.P.	G.P.P.	Alka	Chl.	PO ₄	SO ₄	BOD
pH	1.000	0.491	-0.582	0.981**	0.746	0.988**	0.083	0.769	1.000**	0.284	0.997**	-0.359	0.627	0.960*	0.999**
Temp		1.000	0.994**	0.312	-0.214	0.348	-0.827	0.935*	0.496	0.975**	0.555	0.637	0.987**	0.714	0.457
Turb			1.000	-0.412	0.107	-0.447	0.762	0.967*	-0.586	-0.945*	-0.641	-0.550	0.998**	-0.786	-0.550
Hard				1.000	0.862	0.999**	0.276	0.630	0.980**	0.092	0.963*	-0.534	0.463	0.888	0.988**
Cal					1.000	0.841	0.725	0.148	0.743	-0.426	0.694	-0.889	-0.051	0.531	0.771
Mag.						1.000	0.238	0.659	0.987**	0.130	0.973**	-0.501	0.497	0.905*	0.993**
CO ₂							1.000	-0.573	0.078	-0.932*	0.008	-0.960*	-0.724	-0.198	0.122
D.O.								1.000	0.772	0.832	0.815	0.321	0.980**	0.917*	0.744
N.P.P.									1.000	0.289	0.998**	-0.354	0.631	0.962*	0.999**
G.P.P										1.000	0.355	0.793	0.925*	0.540	0.247
Alkal											1.000	-0.288	0.683	0.979**	0.994**
Chl												1.000	0.502	-0.085	-0.395
PO ₄													1.000	0.819	0.596
SO ₄														1.000	0.949*
BOD															1.000

* = is significant at 0.05 level (2- tailed) ** = is significant at 0.01 level (2- tailed)

Turb = Turbidity, Hard= Hardness, Cal = Calcium, Mag = Magnesium, CO₂ = Carbon-dioxide, Acidt = Acidity, D.O.= Dissolved oxygen, N.P.P. = Net Primary Productivity, G.P.P.= Gross Primary Productivity, Alka= Alkalinity, Chl. = Chloride, Po₄ = Phosphate, So₄= Sulphate, BOD= Biological Oxygen Demand.

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