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Original Research Paper

Seasonal Variation of Physico-Chemical Characteristics of Water in Vignasanthe Wetland of Tiptur Taluk, Tumkur District, Karnataka

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ABSTRACT

The influence of seasonal variations in physico-chemical characteristics exert a profound effect on the distribution and population density of both animal and plant species. In the present paper we carried out the study to evaluate physico-chemical characteristics of water of Vignasanthe wetland located at Tiptur taluk of Tumkur Dist, Karnataka. The constituents monitored include temperature, pH, TUR ,EC, TDS, Cl, TH, Ca, Mg, Alk, NO_3, PO_4, Fe^{2+}, Si, DO, BOD, CO_2, SO_4, COD and DOM. A significant variation in these parameters was observed throughout the study period and monthly comparisons were made as monsoon, premonsoon and postmonsoon. The results of present investigations were compared with earlier available literature and revealed that there is a fluctuation in the physico-chemical characters of the water. This is due to inflow and change in the temperature as season changes.

INTRODUCTION

Wetlands benefit society by recharging aquifers, retaining sediments and nutrients, controlling floods and providing storm protection and microclimate stabilization (Mitsch & Gosselink 1993). Nevertheless, the conservation of these wetlands in India is continuously threatened by the use of natural habitats to meet the demands of society. Some persist in defining wetlands as unhealthy and unproductive areas that need to be drained to improve soil conditions. These ecosystems contain a rich biological diversity and contribute great benefit to the society. Yet they are stressed in India by agriculture use, unplanned tourism land use planning and lack of enforcement of existing environmental laws. These factors have resulted in large unacceptable losses of wetlands, which have had a high social cost. The physical and chemical characters of the wetland water can be used to assess the ecological nature of the wetlands. Several studies have been conducted to understand the physical and chemical properties of lakes, wetlands and reservoir. In such studies the characteristics of the water bodies were taken into consideration with reference to physical and chemical properties; these activities are important for conversation, creation and restoration of similar ecosystems of wetlands. So the present study was undertaken to assess the physical and chemical characteristics of Vignasanthe wetland of Tiptur taluk.

MATERIALS AND METHODS

The study area, Vignasanthe wetland, is located 16 km from Tiptur. The wetland is situated in southern part of Tiptur of Karnataka and is bounded by geographical coordinates 13°08'473" N latitude and 76°32'912" E longitude and having the elevation of 2709 ± 21 ft above mean sea level. It is bounded by Chikkanayakanahalli on north east, Arasikere in the west, Hassan in south west, Yedeyur, the famous pilgrimage in the south east and Tumkur on the east. The wetland has a catchment area of 20 square kilometres (Fig. 1). Water samples were collected for physico-chemical analysis from different sampling stations. Samples were collected once in every month from June 2010 to may 2011. During sample collection in the wetland, necessary precautions were taken to collect the undisturbed water samples. Samples were collected in two-litre blue polythene cans in the morning between 7a.m. to 10a.m. AT, WT, pH, turbidity and EC were determined on the spot. DO was fixed on the site, while other parameters were analysed in the laboratory by standard methods (APHA 2005) and Trivedy & Goel (1984).

RESULTS AND DISCUSSION

The average values and standard deviations of the wet land with respect to physico-chemical parameters are given in Table 2 and shown graphically in Figs. 2 and 3. The average seasonal variations of the above parameters are shown in Figs. 4 and 5. The temperature is one of the most important ecological factors, which controls the physiological behaviour and distribution of organisms. The air temperature (AT) in the respective sampling sites varies from 20.40-34.50°C

with an average value of 27.23°C ± 4.11°C. The observed variation is because of environmental factors. Water temperature (WT) was observed with the variation from 20°C-30.50°C with an average of 24.79°C ± 3.72°C. During winter season water temperature was low due to frequent clouds, high humidity, high current velocity and high water level.

Aquatic organisms are affected by pH because most of their metabolic activities are pH dependant. pH desired limit was also observed by Kulkarni et al. (2009). One of the most important factors that serves as an index for pollution is pH. The pH of Vignasanthe wetland varied between 7.00 and 9.01 with an average of 7.94. It is slightly alkaline. The pH of water was relatively high in the premonsoon and low in the monsoon and postmonsoon during study period. This high value of pH could be due to increased primary productivity wherein carbonates, sulphates, nitrates and phosphates are hydrolysed to hydroxyl ions.

The turbidity is mainly due to the dispersion of suspended solids, from mass bathing, agricultural runoff and domestic sewage. Maximum turbidity was found during monsoon season and minimum in premonsoon. The turbidity values vary from 100.10-25.40 mg/L, with an average of 52.20 mg/L during the study period.

The electrical conductivity values of the water samples ranged between 361 and 745 µmhos/cm with an average of 320.25 µmhos/cm. The maximum values were found in premonsoon, and minimum in monsoon. Conductivity of water depends upon the concentration of ions and its nutrient status and the variation in dissolved solid content. Dilution of water during the rains causes a decrease in the electrical conductance. Similar observation was made by Sulabha & Prakashan (2006).

Oxygen is an important parameter of the wetland, which is essential to the metabolism of all aquatic organisms that possess aerobic respiration. Concentration of dissolved oxygen (DO) decides the quality of water and its relation to the distribution and abundance of various algal species. In the present investigation the DO of water samples ranged from 3.40-9.40 mg/L with an average of 6.09 mg/L. DO is higher in postmonsoon and minimum in monsoon indicating the good water quality. This is also supported by Sahu et al. (2000).

Biochemical oxygen demand (BOD) depends on temperature, biochemical activity, concentration of organic matter and other related factors. During the study period BOD was observed to be in the range of 0.09-4.70 mg/L with an average of 2.04 mg/L during the study period. This is due to low temperature and less bacterial activity. Higher level of DO leads to the maximum values of BOD in premonsoon. Although there is no specific standard set for BOD, the WHO standard indicates 6 mg/L as a limit.

The total dissolved solids (TDS) values of water samples ranged between 212.08 and 452.00 mg/L with an average of 320.25±82.71 mg/L. This is in accordance with the value of BIS (1991). The TDS concentration is high during premonsoon, which may be due to the addition of solids from the runoff water. The amount of total solids is influenced by the activity of plankton and organic materials.

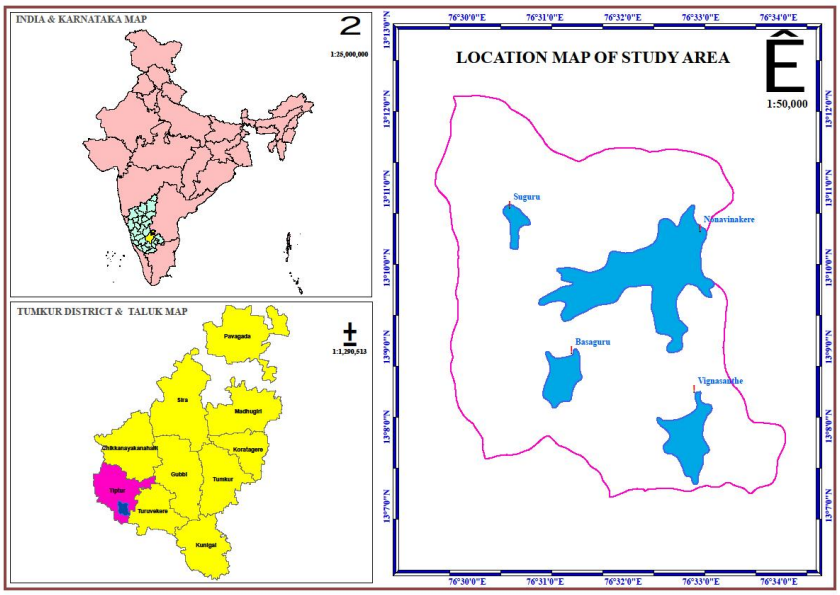

Fig. 1: Sampling location in Vignasanthe wetland.

Table 1: Correlation matrix of different water quality parameters of Vignasanthe wetland during the period (June study 2010 to May 2011)

pH	TUR	EC	TDS	Cl	TH	Ca	Mg	ALK	Aci	NO_3	PO_4	Fe	Si	DO	BOD	CO_2	SO_4	COD	DOM
0.891	0.1018	0.705	0.675	0.766	0.7018	0.733	0.68	0.846	0.389	0.223	0.152	0.477	0.358	0.258	0.48	0.643	0.305	0.789	
	0.211	0.743	0.732	0.58	0.643	0.669	0.628	0.673	0.505	0.236	0.077	0.147	0.198	0.476	0.373	0.551	0.426	0.68	0.174
	1	0.0952	0.171	0.2706	0.077	0.087	0.052	0.261	0.12	0.597	0.854	0.81	0.0621	0.256	-0.0074	0.104	-0.162	0.501	0.309
		1	0.973	0.804	0.737	0.749	0.749	0.806	0.49	0.287	0.076	0.151	0.431	0.424	0.6677	0.9	0.49	0.771	0.045
			1	0.774	0.702	0.709	0.714	0.785	0.464	0.369	0.197	0.172	0.398	0.463	0.631	0.854	0.419	0.787	0.035
				1	0.742	0.772	0.758	0.902	0.391	0.348	0.16	0.447	0.548	0.251	0.702	0.851	0.373	0.722	0.109
					1	0.992	0.99	0.85	0.214	0.136	-0.041	0.324	0.789	0.153	0.766	0.751	0.515	0.664	0.238
						1	0.982	0.851	0.249	0.185	-0.031	0.322	0.745	0.172	0.734	0.746	0.514	0.656	0.251
							1	0.834	0.226	0.157	-0.039	0.302	0.8	0.196	0.742	0.774	0.571	0.625	0.2706
								1	0.266	0.125	0.0824	0.503	0.614	0.082	0.82	0.877	0.294	0.867	0.059
									1	0.447	0.275	-0.071	-0.067	0.795	0.237	0.468	0.696	0.364	0.32
										1	0.642	0.237	0.0163	0.605	-0.022	0.273	0.2	0.274	0.223
											1	0.656	-0.098	0.471	-0.1	0.032	-0.035	0.377	0.388
												1	0.325	-0.045	0.281	0.211	-0.125	0.588	0.36
													1	-0.0019	0.6002	0.545	0.4432	0.347	0.351
														1	-0.0201	0.248	0.684	0.217	0.503
															1	0.807	0.32	0.72	-0.173
																1	0.42	0.723	-0.113
																	1	0.157	0.6005
																		1	0.0275

Table 2: Average values of physico-chemical parameters water of Vignasanthe wetland.

Parameters	Average values of Vignasanthe Wetland
AT	27.23 ± 4.11
WT	24.79 ± 3.72
pH	7.94 ± 0.65
TUR	52.20 ± 27.18
EC	514.83 ± 130.55
TDS	320.25 ± 82.71
Cl^-	14.72 ± 4.85
TH	135.75 ± 50.61
Ca	28.29 ± 9.57
Mg	24.18 ± 9.14
Alk	146.42 ± 46.68
Aci	9.24 ± 2.65
NO_3	0.13 ± 0.06
PO_4	0.16 ± 0.11
Fe	0.11 ± 0.09
Si	0.15 ± 0.25
DO	6.09 ± 1.81
BOD	2.04 ± 1.52
CO_2	0.96 ± 0.37
SO_4	66.67 ± 27.98
COD	14.90 ± 4.25
DOM	0.81 ± 0.48

The values are in mg/L except temperature (°C), EC (micromho/cm), turbidity (NTU) and pH.

Chemical oxygen demand (COD) ranges from 7.40-22.10 mg/L with an average of 14.90±4.25 mg/L. The maximum COD was observed in premonsoon (22.10 mg/L). This is mainly due to the presence of more concentration of organic matter.

Total hardness (TH) depends on the amounts of calcium and magnesium present in the water. During the study period it ranges between 79.00 and 242 mg/L with an average of 135.75 mg/L. This is also within the BIS limit of drinking water (200 mg/L). The high value of TH found during premonsoon is due to evaporation of water and addition of Ca and Mg salts. The observed higher value of alkalinity with respect to hardness indicates the presence of basic salts of sodium and potassium, in addition to those of calcium and magnesium.

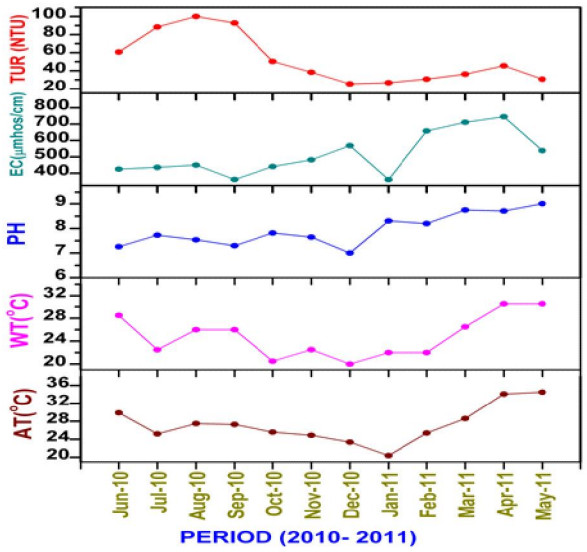

Fig. 2: Monthly variations of AT, WT, pH, EC and TUR.

The variation in nitrate (NO_3^-) content of study area is between 0.01 and 0.28 mg/L with an average of 0.13 mg/L. This could be due to the anthropogenic sources like domestic sewage, agricultural wash offs and other waste effluents containing nitrogenous compounds. The above findings

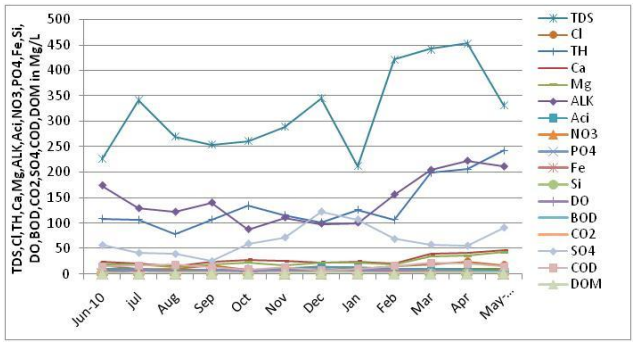

Fig. 3: Monthly variations of TDS, Cl, TH, Ca, Mg, ALK, Aci, NO_3, PO_4, Fe, Si, DO, BOD, CO_2, SO_4, COD and DOM.

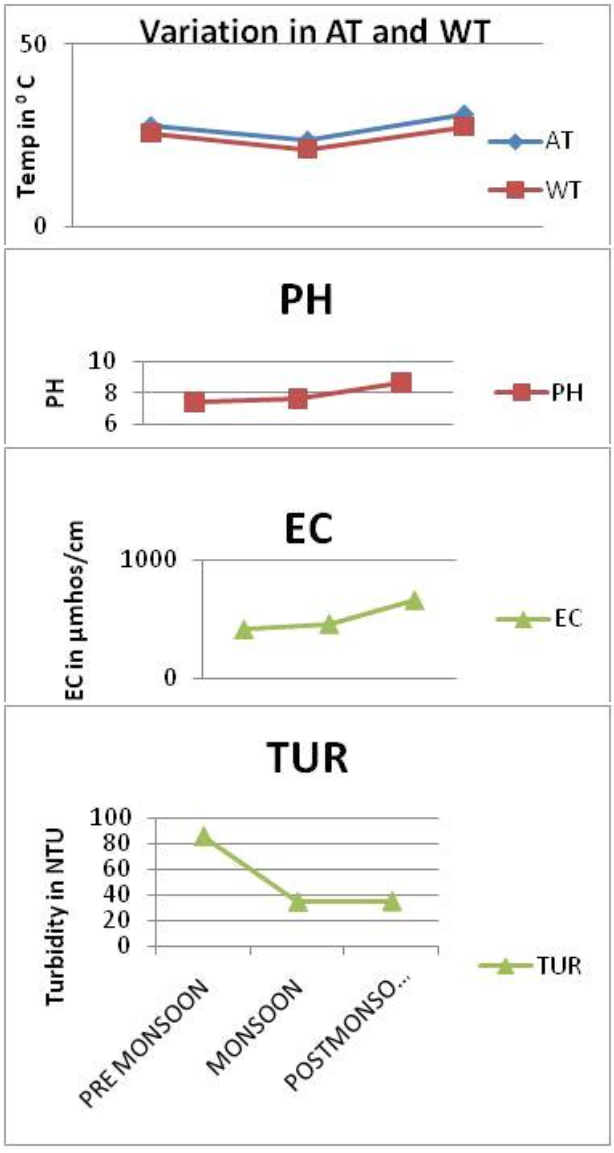

Fig.4: Seasonal variations of AT, WT, pH, EC and TUR.

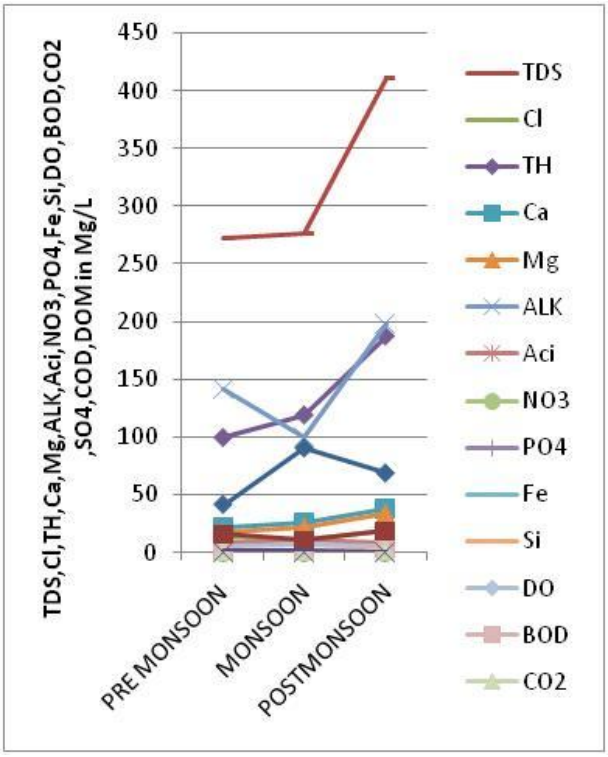

Fig. 5: Seasonal variations of TDS, Cl, TH, Ca, Mg, ALK, Aci, NO_3, PO_4, Fe, Si, DO, BOD, CO_2, SO_4, COD and DOM.

agree with Kulashershtha & Sharma (2006).

The chloride (Cl^-) content was noticed with maximum of 24.10 mg/L, and minimum of 8.6 mg/L with an average of 14.72± 4.85 mg/L. The maximum concentration was noticed in premonsoon. The higher concentration of Cl^- is considered to be an indicator of higher pollution and higher organic wastes of agriculture and dairy origin.

Sulphates (SO_4^{2-}) are in the permissible limit (250 mg/L) and ranges from 26.00-122 mg/L with an average of 66.67 and ±27.98 mg/L. The phosphate concentration varies from 0.02-0.35 mg/L with an average of 0.16 mg/L. The maximum values were observed during monsoon, which could be due to agricultural runoff from fields and detergents rich sewage effluents. This helps in the growth of weeds. Among NO_3^-, Cl^-, SO_4^{2-} and phosphate, phosphate concentration was observed to be relatively lower, but all values were well within the limit. All these above variations of inorganic salts concentration are due to seasonal variation in environmental factors. These results are in agreement with Kulashershtha & Sharma (2006).

All the hydrological and physico-chemical parameters studied showed noticeable variations. Correlations of different parameters are given in Table 1. Water temperature has good correlation with pH and alkalinity; pH is having

significant correlation with EC, TDS and TH. Turbidity shows good correlation with phosphate concentration. EC shows a significant correlation with TDS and CO_2, TDS has significant correlation with CO_2. Chloride with alkalinity and CO_2, total hardness show a good correlation with calcium and magnesium. Calcium with magnesium and acidity show correlations with DO. BOD correlates with CO_2, while other parameters are not correlate with each other.

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