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RESEARCH ARTICLE

ASSESSMENT OF WATER QUALITY USING PHYSICO-CHEMICAL PARAMETERS OF A LENTIC WATER BODY OF JAMMU, J&K

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ABSTRACT

The study of physical and chemical characteristics of water provides a considerable insight into quality of water present in water body. The present investigation was centralized in a pond for one year from May 2012 to April 2013. Various physico-chemical parameters such as water temperature, air temperature, pH, free Co_2, dissolved oxygen, calcium, magnesium, nitrate, sulphate and phosphate were analysed. The results revealed that there was significant seasonal variation in some physicochemical parameters and most of the parameters were in normal range and indicated better quality of pond water.

INTRODUCTION

The world's water resources are under pressure and must be managed for human survival. It is, therefore, necessary to have most relevant information for arriving at rational decisions that will result in the maximum benefit to most people. Ponds have been used as a traditional source of water supply in India but now a days, the water of the ponds is polluted mainly due to discharged waste water from residential areas, detergents and agricultural pesticides from farmlands (Hasan *et al*., 2007). In recent years, their importance has somewhat declined due to technological advancements leading to more centralized water supply systems. The present study is an attempt to assess the water quality of pond in a rural area of Jammu province. Water quality is neither a static condition of a system nor can it be defined by the measurement of only one parameter. There is a range of physical, chemical and biological components that affect water quality and hundreds of variables could be examined and measured. Some variable provide a general indication of water pollution, whereas others enable the direct tracking of pollution source

Study Area

It lies between 32.62^0 N (latitude) and 75.62^0 E (longitude) and at an elevation of 844m above the mean sea level. It is located at a distance of about 2 kms from tehsil Billawar of district Kathua. It is a perennial water body with an area of 300 square meter. The pond is almost circular in shape with irregular bottom. It is surrounded by agricultural fields on three sides and by human settlement on one side. Rain water and surface run off are the main sources of water. The pond water constitutes the prime source of water for the inhabitants of the adjoining areas catering to their domestic needs. Agricultural runoff containing fertilizers, sewage and detergents enrich the pond with nutrients that supports the growth of aquatic plants. Three sampling stations were selected as S-I, S-II and S-III.

MATERIAL AND METHODS

For analysis of physico-chemical parameters of water, monthly sampling was done from May 2012 to April 2013. Water samples were collected in plastic water samplers of 2 litres capacity. Measurement of parameters like air temperature, water temperature, pH, DO, FCO_2, CO_3^{2-}, HCO^{3-}, Ca^{2+} and Mg^{2+} was done on the spot while rest were determined in the laboratory by following the standard methodology of Adoni and A.P.H.A.

RESULT AND DISCUSSION

The physicochemical parameters of the Dewal pond have been given in the Table 1.

Depth

The results obtained from the study showed minimum depth (19cm) during summer (June) and maximum (49.7cm) during monsoon season (August).

Water temperature

Water temperature is an important parameter that plays a prominent role in regulating nearly all other physical and chemical characterstics of water as well as the biological productivity (Wetzel, 2001). Water temperature was corresponding the air temperature and it ranged from 11.7^0C (January) to 30.7^0C (June). Increased water temperature during summer (June) may be linked to increase in day length (Saini, 2009), high air temperature (Manjare *et al*. 2010 and Thirupathiah *et al.,* 2012), clear atmosphere and low water level (Shinde *et al*., 2011).

pH

The pond water was generally alkaline throughout the study period except in the months of May and June, when it becomes slightly acidic exhibiting minima (6.8) in summer (June) and maxima (8.2) during winter season (January). The higher values of pH in winter season was attributed to decreased temperature and high values of DO (Pandey *et al*., 1993). The fluctuation in the pH is because of divergence from the

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equilibrium due to photosynthetic activity and ionic composition due to addition of agricultural and domestic waste (Khan *et al*, 2012). pH showed significant and positive correlation with DO while negative with FCO_2 and Chloride (Table 2).

Table 1 Monthly mean variations in the physico-chemical parameters during May 2012- April 2013.

Months	Depth (cm)	Water temperature (degree celsius)	pH	FCO_2 (mg/l)	DO (mg/l)	Chloride (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Nitrate (mg/l)	Sulphate (mg/l)	Phosphate (mg/l)
May	21.33	25	7.5	13.2	3.41	32.6	25.5	19.41	0.572149	0.001059	0.028932
June	19.0	30.7	6.8	15.9	2.7	42.6	29.4	22.43	0.572269	0.00105	0.047106
July	24.3	28.7	6.9	14.3	3.8	38.2	21.1	15.91	0.572173	0.001221	0.008028
August	49.7	27.7	7.4	13.1	3.9	15.3	8.03	6.6	0.572102	0.001008	0.009744
September	44.7	26.7	7.4	9.86	4.1	21.3	7.8	6.8	0.572031	0.001021	0.008262
October	36.3	22.3	7.2	8.9	4.4	26.6	17.9	13.6	0.572068	0.001004	0.040008
November	24.0	16.3	7.5	6.7	5.7	29.9	12.9	13.7	0.572043	0.001001	0.075264
December	19.3	16	8.1	6.9	6.5	21.2	13.4	13.2	0.572054	0.001	0.052722
January	19.7	11.7	8.2	6.3	7.1	18.6	14.6	8.3	0.572019	0.001097	0.033534
February	26.7	14.3	7.9	7.0	5.3	12.6	13.4	12.7	0.572022	0.001011	0.02823
March	29.0	18.7	7.7	9.2	5.8	19.9	11.8	10.2	0.572048	0.001012	0.02667
April	37.0	21.7	7.7	10.3	5.9	20.7	17.96	13.6	0.572071	0.001044	0.026592

Table 2 Correlation between various physico-chemical parameters (* represent significant correlation).

Parameters	Depth	Water temp.	pH	FCO_2	DO	Chloride	Calcium	Magnesium
Depth	1							
Water temperature	0.353317	1						
pH	-0.15735	-0.87112*	1					
FCO_2	0.107146	0.926447*	-0.80284*	1				
DO	-0.20174	-0.90266*	0.868606*	-0.86583*	1			
Chloride	-0.45515	0.581044*	-0.75652*	0.642746*	-0.60469*	1		
Calcium	-0.58029*	0.39313	-0.49575	0.59324*	-0.49187	0.803796*	1	
Magnesium	-0.62424*	0.337241	-0.488	0.505792	-0.47869	0.804653*	0.936379*	1

DO

Dissolved oxygen is an important parameter vis-à-vis the life present in the water body. The solubility of oxygen and particularly the dynamics of oxygen distribution in inland waters are basic to the understanding of the distribution, behavior, and growth of aquatic organisms. DO values fluctuated from 2.7mg/l to 7.1mg/l. DO was minimum during summer season (June) and maximum during winter season (January). Decrease in DO value during summer (June) may be attributed to high temperature decreasing the oxygen holding capacity of water (Jhingran, 1975), increased day length and light intensity which after acquiring the optimum values, start acting as limiting factor for photosynthesis and hence decreases DO production, consumption due to decomposition of organic matter (Verma, 2009 and Thirupathiah *et al*., 2012) and high metabolic rate of organisms. Inverse correlation of DO and FCO_2 was also reported.

FCO_2

FCO_2 recorded its presence throughout the study period with lowest values (6.3mg/l) during winter season (January) and highest value (15.9mg/l) during summer season (June). Absence of carbonates in most of the months of the year was attributed to the presence of free carbon dioxide.

Chloride

Chloride is an important indicator of organic pollution and its concentration was found to be minimum (12.6mg/l) in the month of February while maximum (42.58mg/l) in the month of June. Increase in chloride content during summer may be due to increased temperature and evaporation of water, low water level (Lashari *et al*., 2009 and Sahni and Yadav, 2012), inflow of waste (Savita, 2013), increased decomposition rate and high organic matter (Sharma *et al*., 2013). Calcium and magnesium showed positive and significant correlation with chloride.

Calcium

Calcium level showed its decline (7.8mg/l) during monsoon season (September) with a rise (29.4mg/l) during summer season (June). Rapid rate of decomposition of organic matter at high temperature (Billore, 1981), increased rate of evaporation and low water level (Bhat *et al*., 2012) might be responsible for high calcium during summer.

Magnesium

Concentration of magnesium recorded its minima (6.59mg/l) in the month of August and maxima (22.43mg/l) in the month of June. Increase in magnesium during summer may be due to high atmospheric temperature and increased rate of evaporation (Shastree *et al*., 1991 and Jyoti *et al*., 2009), low water level (Shastree *et al*., 1991), microbial decomposition of organic matter (Jyoti *et al*., 2009) and direct relation with calcium (Verma, 2009).

Nitrate, Sulphate and Phosphate

The nitrate, sulphate and phosphate values did not show much fluctuations during the study period and ranged from 0.572019mg/l (January) – 0.572269mg/l (June), 0.001mg/l (December) – 0.001221mg/l (July) and 0.008028mg/l (August) – 0.075264mg/l (November). Presence of nitrates in water indicates the final stage of mineralization.

The result revealed that there was significant seasonal variation in some physicochemical parameters and most of the parameters were in the normal range and indicates better quality of pond.

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