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Physico-chemical study of Moghat Reservoir at Khandwa, Madhya Pradesh

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Abstract

The present study has been carried out on Moghat Reservoir situated at Khandwa District of Madhya Pradesh. In the present study, the water samples were analyzed for various physico-chemical parameters like temperature,transparency, turbidity, TDS, pH, Free CO_2, total hardness, Ca hardness, Mg hardness, DO, BOD and COD on two different sites of the reservoir. During the course of study value of DO fluctuated between 6.04 mg/l to 8.58 mg/l. Value of BOD and COD fluctuated from 0.98 mg/l to 3.51 mg/l and 9.0mg/l to 12.3mg/l respctively. It was found that around all the parameters were more or less similar at both the sampling stations. The water quality was found suitable but it is strongly recommended that regular monitoring of the Moghat reservoir at Khandwa is very important as it is the major source of freshwater. Thus it is apparent that much attention should be paid on further studies of the physico-chemical and biological parameters of the Moghat reservoir

Keywords:

Introduction

The lake and reservoirs containing fresh water are used for fish culture, aquaculture, navigation and transport, recreation, irrigation hydropower generation and a host of such other purposes. They are also the sources of water for drinking, household and industrial requirements. They serve as the most convenient and cheapest refuse dumping places for domestic and industrial wastes. So water bodies are heated, polluted and excessively fertilized. The fresh water is becoming rare day by day as civilization draws nearer. Its quality has also equally deteriorated. Now man started realizing the effect of this pollution problem and trying to improve the quality of the water to reuse the same.Aquatic life is influenced directly or indirectly by the physical, chemical and biological factors, fluctuation in any one of the factors may create an adverse environment to the organisms, affecting their growth and life phenomena. All the hydrobiologists have established these facts.The present study has been carried out in Moghat reservoir which is located 3 kilometer away from the Khandwa city in northwest. The geographic position of this reservoir is 21 – 49' N and 76 –20' E. It is situated 1071 ft. above from mean sea level. The surface area of the reservoir is 2.02 sq. Km with the maximum depth 5.2 m. and mean depth 1.2 m. it has 5.36 kilometer long shoreline. No known source of pollution is there. Only rainwater brings the dead organic matter and some agricultural effluents from its catchments area.

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Material and methods

For present study of the Paniyala pond, the water samples were collected monthly from four different sampling sites during March 2008 to February 2009 in morning hours. The samples were taken in borosil glass bottles of 300 ml and plastic cans of 1.0 L from each location. The collection and analysis of water samples was done using standard methods with the help of Welch (1948), Trivedi and Goel (1986), APHA (1998) and Khanna and Bhutiani (2003) for physico-chemical parameters.

Sampling stations –For the present study a total of four sampling stations were selected for physicochemical studies of the reservoir i.e.
SITE I: Southern shore of the reservoir.
SITE II: Eastern shore of the reservoir

Results and Discussion

The results and data collected on physico-chemical parameters during the present investigation are presented in Table 1 and 2. Temperature can be

described as a condition that is responsible for the transfer of heat within bodies. Temperature contributes to the solubility of H_2, N_2, CO_2 and O_2 which play vital roles in aquatic ecosystems (Gillooly *et al*. 2002). In the present study temperature was reported maximum of 31.44^oC in the month of July and minimum of 21^oC in the month of January. Das (1989) expressed that the lakes which do not come under oligotrophic and eutrophic status and fall intermediate between oligotrophic and eutrophic can be termed as mesotrophic. Edmondson *et al.* (1956) emphasized the importance of transparency in determining the lake trophic status. Sharma (1980) has also attempted to classify water bodies on the basis of water clarity values. Transparency was reported maximum of 9.12 cm in the month of June and minimum of 3.98 cm in the month of December. Turbidity was reported maximum of 28 JTU in the month of August and minimum of 13 JTU in the month of December. TDS was reported maximum of 220 mg/l in the month of July and minimum of 110 mg/l in the month of February.The pH of pond water in general showed an alkaline tendency during all the months (Table 1). The maximum pH noticed in the study period was 8.35 in the month of May and the minimum pH noticed was 7.12 in the month of October. pH showed a negative correlation with temperature and Free CO_2(Table 3). Low pH also interferes with oxygen uptake, and pH outside range of 4.00 to 10.00 can kill fish (Mathew, 1998).The maximum free carbon dioxide was observed (3.60 mg/l) in monsoon season because of the slightly higher temperature of water and higher turbidity, which lowers the rate of photosynthesis and thus the dissolved oxygen. However, it was minimum (1.0 mg/l) in the winter season when the temperature of water decreased and also the turbidity was almost nil.Ray *et al.* (1966) have reported that the Ganga river contains maximum free carbon dioxide (free CO_2) in the rainy season in Allahabad also recorded the maximum free carbon dioxide in Yamuna during monsoon season at Allahabad. The free carbon dioxide is released during the decomposition of certain substances and because of respiration of the prevailing living organisms. Since higher temperature regulates the decomposition of organic substances and also the respiration of the living biota, a direct relationship existed between free carbon dioxide and water temperature.The total hardness during the overall study ranged with maximum (131.04 mg/l) in Monsoon season and minimum (111.98 mg/l) in winter season. The phosphate and nitrate are mostly decomposition products of organic waste/matter. Hardness in water is mainly because of presence of calcium and magnesium in the water and its source may be industrial, domestic or commercial waste and sewage but one of the main sources of calcium is natural rocks of that area.

Table 1 – Monthly variation in Physico-chemical parameters of sampling Site I

Months	Temp (^{0}C)	Transparency (cm)	Turbidity (JTU)	TDS (mg/l)	pH	Free CO_2 (mg/l)	Total Hardness (mg/l)	Ca Hardness (mg/l)	Mg Hardness (mg/l)	DO (mg/l)	BOD (mg/l)	COD (mg/l)
October	30.1	4.24	15	179	7.12	2.12	120.15	27.4	11.4	7.0	2.78	9.1
November	22.5	8.02	18	187	7.98	1.01	115.00	26.5	10.9	7.98	2.50	9.0
December	21.4	3.98	12	130	7.85	1.00	114.02	26.1	12.50	8.21	1.99	9.2
January	21.0	5.87	16	128	8.01	1.30	118.00	25.7	13.29	7.88	2.01	9.5
February	22.6	5.23	15	154	7.88	1.28	120.21	26.2	14.15	6.98	2.98	9.9
March	24.5	6.56	19	125	7.54	1.43	123.00	29.7	15.64	6.04	3.51	10.3
April	26.4	7.12	22	178	7.64	2.23	128.00	30.4	16.10	6.78	2.88	10.5
May	29.5	7.56	27	142	7.36	3.60	131.04	33.5	22.3	6.98	2.78	10.7
June	30.2	6.40	24	186	8.06	2.60	127.25	34.8	23.8	7.56	2.15	11.1
July	29.8	5.40	26	195	8.09	2.30	111.98	28.4	10.80	7.54	2.10	10.6
August	26.9	8.70	28	175	8.04	2.45	119.58	27.1	9.78	8.12	1.98	9.7
September	27.1	7.48	24	138	7.99	2.23	121.21	25.9	10.09	7.11	2.01	9.1
Average ± SD	26 ±3.51	6.38 ±1.48	20.5 ±5.37	159.75 ±26.17	7.80 ±0.31	1.96 ±0.78	120.79 ±5.81	28.48 ±3.05	14.23 ±4.61	7.35 ±0.65	2.47 ±0.51	9.89 ±0.73

Table 2: Monthly variation in Physico-chemical parameters of sampling Site II

Months	Temp (^{0}C)	Transparency (cm)	Turbidity (JTU)	TDS (mg/l)	pH	Free CO_2 (mg/l)	Total Hardness (mg/l)	Ca Hardness (mg/l)	Mg Hardness (mg/l)	DO (mg/l)	BOD (mg/l)	COD (mg/l)
October	22.50	5.54	14	180	8.26	1.57	119.21	22.54	15.45	6.98	2.45	9.9
November	24.65	4.98	13	169	8.24	1.90	121.12	26.12	10.94	7.01	2.22	9.3
December	26.54	5.04	13	163	8.27	1.24	124.50	24.45	11.54	7.24	1.98	10.1
January	27.85	6.78	16	129	8.24	1.44	118.00	25.54	13.43	8.58	0.98	10.3
February	27.12	5.98	14	110	8.25	1.99	117.58	23.02	16.54	8.01	1.01	10.7
March	26.45	4.89	15	134	8.27	2.01	126.54	27.87	12.41	7.98	2.01	11.1
April	28.87	5.12	15	159	8.29	1.89	127.44	26.54	15.32	7.56	2.24	11.5
May	29.32	8.02	18	187	8.35	2.87	121.21	24.56	14.21	7.45	2.56	11.6
June	30.25	9.12	21	219	8.30	2.89	131.02	27.88	13.21	7.86	2.87	12.3
July	31.44	8.78	22	220	7.51	2.77	129.87	26.54	14.22	7.65	2.55	11.9
August	28.57	7.89	20	192	7.64	2.99	124.56	21.25	16.45	7.02	1.65	11.3
September	24.58	7.56	17	186	8.24	2.48	119.20	24.65	13.24	6.98	3.01	10.8
Average ± SD	27.35 ±2.58	6.64 ±1.58	16.50 ±3.12	170.67 ±34.08	8.16 ±0.27	2.17 ±0.61	123.35 ±4.64	25.08 ±2.08	13.91 ±1.80	7.53 ±0.51	2.13 ±0.65	10.90 ±0.89

Table: 3 Pearson correlation coefficient between physico-chemical parameters of Moghat Reservoir

	Temperature	Transperancy	Turbidity	TDS	pH	Free CO_2	Total Hardness	Ca Hardness	Mg Hardness	DO	BOD
Temperature											
Transperancy	0.63										
Turbidity	0.74	0.93									
TDS	0.34	0.69	0.73								
pH	-0.44	-0.47	-0.64	0.45							
Free CO_2	0.57	0.82	0.85	0.66	-0.47						
Total Hardness	0.64	0.32	0.56	0.57	-0.36	0.42					
Ca Hardness	0.34	0.02	0.14	0.1	0.23	0.02	0.58				
Mg Hardness	0.19	0.24	0.26	-0.05	-0.32	0.29	-0.13	-0.59			
DO	0.45	0.08	0.1	-0.47	0.15	-0.15	0.05	0.44	0.04		
BOD	-0.02	0.35	0.35	0.78	0.03	0.44	0.43	0.33	-0.27	-0.53	
COD	0.82	0.7	0.81	0.48	-0.31	0.75	0.68	0.32	0.34	0.28	0.33

During the study the maximum value of calcium and magnesium observed was (34.8 mg/l) and (23.8 mg/l) respectively and the minimum value observed for calcium and magnesium was (25.7 mg/l) and (9.78 mg/l).Oxygen occurs naturally in the atmosphere as gas and is also produced via photosynthesis. Oxygen is not readily soluble in water, and its solubility relies on temperature, salinity and atmospheric pressure (DWAF, 1996). Dissolved oxygen (DO) is critical for sustenance of aquatic life in order for aerobic species to be able to survive and carry out their ecological functions. Lack of DO can lead to anaerobic decomposition of organic matter, resulting in unpleasant odour that is indicative of formation of hydrogen sulphide and ammonium (Schindler, 1981).The concentration of DO during present study was recorded with the maximum of 8.21 mg/l in the month of December and minimum of 6.04 mg/l in the month of March. D.O was found correlated positively correlated with

transperancy and pH (table 3). BOD is the measure of degradable organic matter present in a water sample and is defined as the amount of oxygen required by microorganisms in stabilizing biologically degradable organic matter under aerobic conditions. BOD of the pond water during the study varied from minimum of .98 mg/l in the month of January to the maximum of 3.51 mg/l in the month of March. BOD was found significantly negatively correlated with Mg. hardness and D.O. Calcium is one of the most abundant substances in natural water. The quantity of Ca in natural water generally varies from 10-100 mgL-1 depending on the type of rocks (Trivedy and Goel, 1986). Magnesium occurs in all kinds of natural water with calcium, but the concentration remains generally lower than that of calcium. Calcium and magnesium showed significant positive correlation with temperature.

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