

Pollution Status Of A Hypertrophic Fresh Water Pond Of District Mirzapur

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Fresh water Pond selected for present study is situated in the village Manguri which belongs to Chetganj town area of district Mirzapur. It can be referred as hypertrophic pond as it receives various types of waste from surroundings, such as agricultural run off (containing non-biodegradable pesticide and fertilizers) household or domestic waste, soap and detergents and organic waste (cow dung) load along with temple garbage. This pond has been studied for pollution with special emphasis on physico-chemical characteristics. The level of pollution was found to reach the maximum during summers. The pond water contains high level of pH, Alkalinity, BOD & COD. Total suspended solids, Dissolved solids, Nitrates, Phosphates & heavy metal Chromium also exceeds the permissible limit.

Key words: Hypertrophic, Non-Biodegradable.

1. INTRODUCTION

Pollution is an inevitable problem in India. It is increasing day by day around industrial and urban centers. Due to population explosion, urbanization, lack of proper sanitary facilities and direct discharge of agricultural run off, domestic and municipal waste the water quality of aquatic biota has deteriorated rapidly [1,2,3,4,5,6,7,8]. Eco-degradation of ponds has been increasing due to poor environment Management in the catchment area and variety of factors [9,10,3,11,12,13,14,15,16,17,].

Thus, it was considered worth-while to monitor water pollution level in Chetganj pond, Mirzapur and also to investigate the fish production propensities in it, so that this important fresh water resource can be properly retrieved and the ecosystem of this area can be prevented from gradual degradation.

2. MATERIALS AND METHODS

An intense and thorough survey of the selected pond was made which resulted that Chetganj pond is a perennial pond. The ultimate source of water for it, is annual rains. It covers the total area of 5 beegha and it is approximately 15 feet deep. It is square in shape and has the 4, 28,000 liters water holding capacity. There exist four staired Ghats in the vicinity of the pond in all the four directions. At present all the four Ghats are being used by the villagers to wash their clothes. This pond can be referred as hypertrophic pond as it receives various types of waste from surroundings, such as agricultural run off (containing non-biodegradable pesticide and fertilizers) household or domestic waste, soap and detergents and organic waste (cow dung) load along with temple garbage.

To analyse the physico-chemical Parameters water samples were collected from the

aforesaid pond in 500ml. plastic bottles on monthly interval for one year from Jan.2010 - Dec 2010. All the samples were analysed within 72hr following the methods given by [18].

Table 1 Physico-chemical characteristics of Chetganj pond during 2010

No.	Parameters	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.	Temperature (°C)	18	21.9	26.5	29.2	32.5	36.5	32.1	28	27.1	25.3	23.4	20
2.	Turbidity (NTU)	510	430	460	500	530	562	1530	1580	1620	1240	850	630
3.	T.S.S.	830	910	962	1080	1178	1220	1299	820	730	809	770	802
4.	T.D.S.	400	420	480	511	560	630	309	327	340	366	401	380
5.	T.S.	1230	1330	1442	1591	1738	1850	1608	1247	1070	1175	1171	1182
6.	pH	9.1	9.1	9.2	9.4	9.4	9.5	8.5	8.3	8.1	8.4	8.6	8.8
7.	DO	4.7	4.3	3.9	2	2.6	2.5	6.5	8.2	8.8	8.5	6.7	5
8.	BOD	149	165	200	230	246	275	80	93	82	104	116	130
9.	COD	202	215	260	279	315	308	140	165	130	172	189	197
10.	Alkalinity	120	146	240	295	370	480	68	62	50	70	82	96.0
11.	Hardness	120	138	176	250	318	350	97	82	85	92	105	112
12.	Chlorides	77	85	92	98	110	130	58	63	70	66	72	80
13.	Nitrates	15.8	16.2	17	16.1	15.4	14	12.4	13.1	12	13.5	14.2	15.1
14.	Phosphates	21	22.1	20.2	19.7	19.1	18.6	17.9	18.2	17.6	18.9	19.8	20.7
15.	Chromium	1.7	2.1	2.5	2.9	3.1	3.4	1.8	1.2	1.5	1.9	2.0	2.3

All the values in mg/l except temperature, pH & turbidity (NTU)

3. RESULT & DISCUSSION

To evaluate the extent of pollution entering into the Chetganj pond its physico-chemical characteristics were analysed monthly during 2010 (January-December) and are being expressed in the Table1.

3.1 PHYSICAL PARAMETERS

3.1.1 TEMPERATURE

Temperature controls behavioral characteristics of aquatic organism, solubility of gases and salts in water. No other factor has so much influence as temperature. During course of study it fluctuated between 18-36.5°C (Table-1). These fluctuations were found within the tolerance limit (25-35°C for carps) for animals inhabiting the pond as shown in Fig.1.

Correlation between temperature, pH & DO during 2010

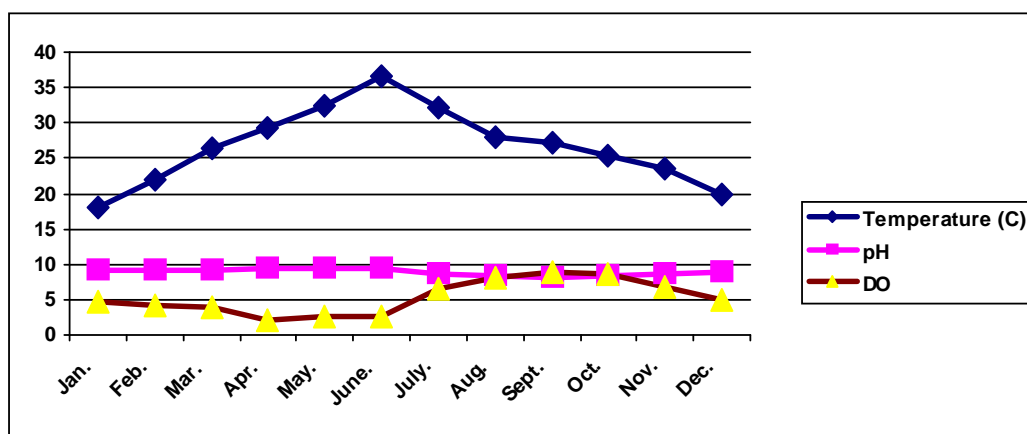


Fig. 1

3.1.2 TURBIDITY

Turbidity which results from planktonic organisms is a desirable trait whereas that caused by suspended clay particles is undesirable. Values of turbidity ranged between 430-1620 NTU during 2010 (Table-1). Actually the allochthonous matter reaching the pond through runoff coupled with phytoplankton during rainy season increased turbidity and decreased transparency of aquatic ecosystem [19].

3.1.3 TOTAL SUSPENDED SOLIDS (TSS)

TSS are considered to be pollution indicator as it show an increasing affinity with the pollution condition. During present investigation the values ranged between 730-1299 mg/l during 2010 (Table-1, Fig. 2). Extremely high concentration of TSS was noticed which indicates that pond water can not sustain fish fauna [8,16].

Correlation between TSS, TDS & TS during 2010

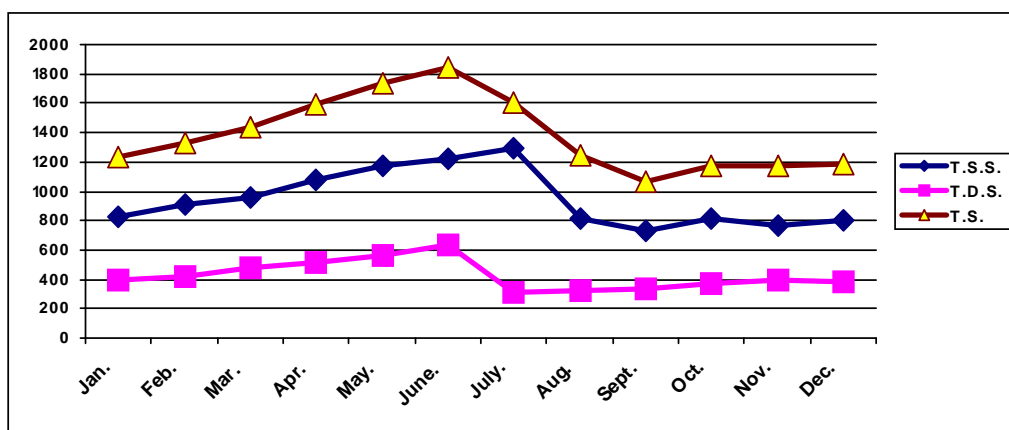


Fig. 2

3.1.4 TOTAL DISSOLVED SOLIDS (TDS)

Total Dissolved solids denote mainly various kinds of mineral present in the water. The values of TDS ranged between 309-630 mg/l during 2010 (Table 1). TDS values were also showed higher trend in comparison to WHO standards 2003 [20] (500 mg/l) (Fig. 2).

3.1.5 TOTAL SOLIDS (TS)

TS of water body includes TSS and TDS. The values of TS ranged between 1070-1850 mg/l during 2010 (Table 1). The direct relationship between rainfall and total solids was attributed to an increased load of soluble salts from the catchment areas as a result of surface run off (Fig. 2).

3.2 CHEMICAL PARAMETERS

3.2.1 HYDROGEN ION CONCENTRATION (pH)

The pH was alkaline and ranged between 8.1-9.5 during 2010 (table-1). Highest values were observed during summer, which were due to the low water level and presence of variety of waste in the water. High photosynthesis of micro and macro vegetation resulting in high production of free CO_2 has shifted the equilibrium of water towards alkaline side. It is known that pH of water does not cause any severe health hazard. However, conversion of organic matter is comparatively faster in alkaline waters which produce foul smell. In the present investigation pH values were slightly above the WHO standards 2003 [20] (6.5-8.5) (Fig. 1).

3.2.2 DISSOLVED OXYGEN (DO)

The values of DO ranged between 2-8.8 mg/l during 2010 (Table 1, Fig. 3). The amount of oxygen available in natural water is governed by several factors like temperature, biochemical degradation of organic matter respiration, photosynthesis and salinity. The rate of depletion of oxygen content has been used as criteria to evaluate the quality of

water bodies. Relatively higher values of DO during winter were due to increased solubility of oxygen at lower temperature. The concentration of DO in the pond water was below permissible limit of 5 mg/l [20] during all the seasons except rainy. Under such conditions the pond water can not sustain fish population [21]. Dissolved oxygen of an aquatic biota is a critical attribute as its low concentration adversely affects fish population even at levels which do not cause mortality, making them more susceptible to parasites and diseases, and also decrease the metabolic rate and spawning of the aquatic animals [22]. High DO in rainy season was due to constant aeration as well as turbulence while passing through riffles due to heavy rains [23].

3.2.3 BIOLOGICAL OXYGEN DEMAND (BOD)

BOD determines the relative oxygen necessary for the biological oxidation of the organic matter in water. The BOD of pond water ranged between 80-275 mg/l (Table 1) which gives an indication of heavy organic pollution load on water body (Fig. 3).

Correlation between DO, BOD & COD during 2010

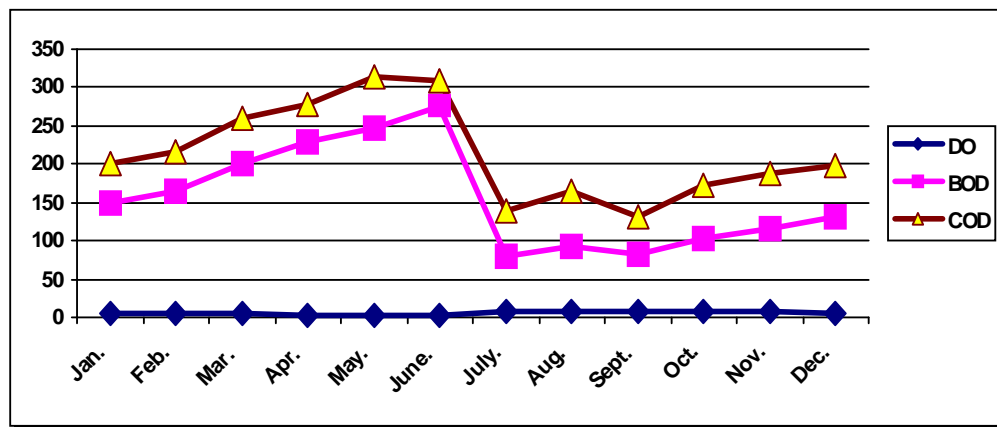


Fig. 3

3.2.4 CHEMICAL OXYGEN DEMAND (COD)

COD determines the relative amount of the oxygen necessary for the complete chemical oxidation of the organic matter in water. The value of COD ranged between 130-315 mg/l (Table 1) which indicate towards the chemical pollution load on the water body. (Fig. 3).

3.2.5 ALKALINITY

The values of alkalinity ranged between 50.5 480 mg/l (Table 1) during 2010. Higher values of total alkalinity registered during summer were due to the presence of excess of free CO_2 produced as result of decomposition process. Alkalinity it self is not harmful to human being but the desirable limit for drinking and domestic use is 100 mg/l. The pond under present investigation with its alkalinity could be placed in "high" category of nutrient type [20]. The reason for this was very largely the reduction of pond flow and the proportionately greater effect of the domestic sewage effluents. Bicarbonates were very low during the monsoon and highest in the cold season. Carbonate alkalinity was present almost throughout the year except for a few months, when free CO_2 was

present in the water. The fall of carbonate in certain months and its absence in other was due to the excess of carbon di-oxide, to the formation of carbonic acid ions in the water and to the increase in photosynthetic activity of submerged plants & phytoplankton [16].

3.2.6 HARDNESS

Total Hardness ranged between 82-350 mg/l (Table 1) during 2010. High values of hardness during summer can be attributed to low water level and high rate of evaporation. Addition of domestic sewage, detergent and large scale human/cattle waste from the surroundings were also cause of elevation in hardness [24].

3.2.7 CHLORIDES

Chlorides occur naturally in all types of water in natural fresh water however; its concentration was quite low in the Chetganj pond water. The values of chlorides ranged between 63-130 mg/l (table-1) during 2010. Although chlorides are not harmful but its concentration beyond 250mg/l imparts a peculiar taste to water rendering it unacceptable from aesthetic point of view and for drinking purpose [20].

3.2.8 NITRATES

The dissolved nitrogen in water vary seasonally indicating the intensity of productivity of a pond. The values of nitrate in Chetganj pond ranged between 12-17mg/l (Table-1) during 2010. The increase in nitrate contents during monsoon month is mainly because of anthropogenic activities viz. run off water from nearby agricultural lands, discharge of organic waste and other waste containing nitrogen species and other subsequent oxidation by microbiological activity under aerobic conditions which in turn affect the aquatic life. The nitrates were found within permissible limit at the sampling station (50mg/l) [20]

3.2.9 PHOSPHATES

Phosphates are considered as a chemical nutrient regulating the plant production in aquatic environment. In natural water phosphates are utilized by the algae and it enters through surface run off. The values of phosphates in Chetganj pond ranged between 17.9-22.1mg/l (Table 1) during 2010. Phosphates can also be pointed out as an indicator of aquatic pollution by organic matter and is principal causative agent for the eutrophication of water bodies and consequential deterioration [25]. Intensive algal growth usually depletes ponds phosphates to low level. Ecologically phosphorus is often considered as the most critical single element in the maintenance of aquatic productivity However, excess of phosphorus in open water is a sign of heavy organic pollution.

3.2.10 CHROMIUM

The harmful effect of Cr to human is mostly associated with its hexavalent form. The values of chromium in Chetganj pond ranged between 1.2-3.4mg/l (table-1) during 2010. The drinking water standards (International standards for drinking water 0.1 mg/l) [20] and standards for discharge for chromium on inland surface water (Tolerance limit for industrial effluent part 1- New Delhi 1981-0.5 mg/l) indicates that pond water bears high level of chromium which might be reaching there through seepage from carpet waste as

small scale units of carpet making exists in the vicinity of pond and thereby creating serious health hazards to the aquatic flora and fauna.

Thus, it can be concluded that Chetganj pond showed increased concentration of pH, alkalinity, TSS, TDS, nitrates, phosphates & heavy metal chromium. Depletion in water quality rendering the water unfit for fish culture and even for domestic use. Man made pond holds tremendous potential for inland fisheries in India. However, this vital resource is not contributing to the inland fish production as propensities of production are not channeled in right direction. In chetganj pond. The co-relation between the physico-chemical characteristics and toxic variables of surroundings have caused the disappearance of fish fauna with their back stroke phenomenon. Therefore, it is high time to monitor such pre-existing water resources from further deterioration, to contribute in solving the emerging water crises in India otherwise; these resources will prove fatal and produce ill effects on the environment.

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