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Study on pH and organic carbon of soil sample collected from three different urban ponds of Nadia district, West Bengal, India

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Abstract
The present study was carried out to make a study on pH and Organic carbon of soil sample of three urban ponds of Nabadwip at Nadia district, West-Bengal. The monthly mean variation in soil pH ranged between 7.35 (January) and 8.61(May) in P-1, 6.21(January) and 6.90 (June) in P-2 and 6.20 (Feb) and 6.82(June) in P-3. The maximum mean value was recorded in P-1 and minimum in P-3. The soil pH was significantly highest (p<0.05) in the month of May than other month in P-1 but in case of P-2 and P-3 it showed significantly maximum value (p<0.05) in the month of June. In the present study the percentage of organic carbon varied from 2.43 (January) and 2.50% (April, May, June) in P-1, 2.53 (January) to 2.79% (May) in P-2 and 0.029 (January) to 2.26% (June) in P-3. The maximum average value (2.61%) was found in P-2 and minimum in P-3 (1.37%). The soil organic carbon was significantly highest (p<0.05) in June than other months in both P-1 and P-3. There was significant variation was found in between the months of May and June in P-1. In P-2 the maximum significant variation (p<0.05) was found in the month of May, but there was no significant variation (p>0.05) between the month of May and June. The present finding established that, the well managed pond (P-2) showed better ecological conditions compare to unmanaged ponds.

Keywords: Soil characteristic, Soil pH, Organic carbon, urban ponds, management practices, Nabadwip

1. Introduction
The productivity of a pond depends upon a large number of animal and plant communities living in its various zones. Aquatic organisms are dependent on water. Suitable water quality parameters play an important role on adaptability, growth and reproduction (Hubert *et al.* 1996) [12].

The productivity of a pond or lake depends upon the quality of its water and soil (Biggs *et al.* 2005) [5].

Suitable water quality depends on the quality of the total environment of that geographic region. Fresh water has become a scarce commodity due to over exploitation and pollution (Singh and Mathur, 2005; Gupta and Shukla, 2006) [16, 11].

Industrial, sewage and municipal wastes are being continuously added to the water reservoirs affecting the physico-chemical quality of water making it unfit (Dwivedi and Pandey, 2002) [10].

Uncontrolled discharge of domestic waste water into the ponds has resulted in eutrophication of ponds (Pandey and Pandey, 2003) [14].

Hydrological condition of water affects the aquaculture activities, fish productivity and species composition of aqua fauna, eutrophication and overall loss of biodiversity that results in degradation of pond ecosystem. The magnitude and dynamics of oxidation-reduction reaction by various elements present in water plays an important role in governing most of the chemical, biochemical and microbial behaviors in the pond water, and also maintaining congenial environmental condition. The major changes associated with electro-chemical properties of pond water are reflected by the pH and organic carbon of soil.

The study of different physico-chemical parameters is very important for understanding the metabolic events in aquatic ecosystem. The parameters influence each other and govern the distribution and abundance of flora and fauna (Shinde *et al.* 2011) [15].

Many authors have already studied in several areas in Nadia district, West-Bengal. Kumar (1985) [13] reported water quality characteristics in beel, Bala and Mukherjee (2011) [2] also

studied water quality parameters of sixty wetlands, Das *et al.* 2009 [9] recorded physico-chemical parameters of three reservoirs, Bhaumik *et al.* (2006) [4] also observed physico-chemical parameters of two beels. But, there were no such studies from this region and therefore a study of pH and Organic carbon of soil was undertaken in different ponds from Nabadwip municipal areas to check the pond water quality with different management practices of these urban ponds.

2. Materials and Methods

2.1 Study area

The present study was carried out for a period of six months from January 2017 to June 2017. Three ponds with different management practices were selected to make a comparative ecological study among them. The water bodies identified for the present study are situated within the municipal boundary of Nabadwip, West Bengal. First pond (P-1), Station Road Pond moderately managed is situated near Nabadwip railway station with around 7000 m^2 area and surrounded by cemented wall. Second pond (P-2), situated at Tegharipara, an earthen well managed pond with 6500 m^2 area. The third pond (P-3), namely Gobinda Dighi pond is situated near Royal club, highly unmanaged with 5600 m^2 area. General features of the three ponds were provided in the Table 1.

Table 1: General features of three studied ponds under urban Nadia.

Features	P-1 (Station Road Pond)	P-2 (Tegharipara Pond)	P-3 (Gobinda Dighi pond)
Area (m^2)	7000	6500	5600
Average Depth (m)	5-6	6-7	3-4
Type of water body	Perennial	Perennial	Perennial
Source of water	Rain fed, water seepage and surface run off.	Rain fed, water seepage and surface run off.	Rain fed, water seepage and surface run off.
Purpose of use	Domestic purposes, washing, bathing, idol immersion etc.	Bathing without soap, cooking. Vehicle washing and idol immersion not allowed.	Bathing, washing, dumping, domestic purpose, idol immersion etc.
Management status	Moderately managed, concrete dyke, fish culture practices.	Well managed, regular cleaning and monitoring, natural earthen dyke, fish culture practices.	Unmanaged, no proper cleaning and monitoring, no such type of fish culture.

2.2 Methods

Sediment of the pond-1 (Station Road Pond) and pond-3 (Gobinda Dighi pond) were collected by Ekman bottom sampler grab. But the sediment of pond-2 (Tegharipara pond) was collected by hand. The pH of the sediment was estimated before drying. The sediment samples in hot air oven at 103˚C temperature for 24 hours and pulverized to fine size and sieved through a standard test sieve (1 S No.40 S; pore size 0.425 mm).The sieved samples were used for the estimation of organic carbon.

Table 2: Standard methods followed for analyzing the soil parameters of three studied ponds under urban Nadia.

Sl. no.	Parameter	Method	Reference
1.	Soil pH	1:5 sediment suspension in water was used for the determination of pH meter (Eutech pH meter).	Tan, 1996 [18]
2.	Soil Organic carbon	Chromic acid method.	E ll Wakeel and Riley, 1957 [20]

3. Results and discussions

3.1 Soil pH

Table 3: Pond wise monthly variation in Soil pH

Month	P1(Station Road Pond)	P2 (Tegharipara Pond)	P3 (Gobinda Dighi pond)
JAN	7.735 ± 0.091	6.21 ±0.021	6.26 ±0.049
FEB	8.05 ± 0.070	6.38 ±0.113	6.20 ±0.007
MAR	8.1 ± 0.141	6.57± 0.035	6.55± 0.077
APR	8.32 ± 0.028	6.48 ±0.028	6.63 ±0.028
MAY	8.61 ± 0.035	6.635 ±0.049	6.74 ±0.056
JUNE	8.37 ±0.042	6.90 ±0.021	6.82 ±0.028

The monthly mean variation in soil pH ranged between 7.35(January) and 8.61(May) in P-1, 6.21(January) and 6.90(June) in P-2 and 6.20 (Feb) and 6.82(June) in P-3 (Table.3). The maximum mean value was recorded in P-1 and minimum in P-3. The soil pH was significantly highest (p<0.05) in the month of May than other month in P-1 but in case of P-2 and P-3 it showed significantly maximum value (p<0.05) in the month of June. pH of the sediment like the overlying water, is controlled by many environmental parameters and undergoes fluctuations depending upon the nature of soil. In the present study the average sediment pH concentration of the water body P-1, P-2 and P-3 were 8.19, 6.53 and 6.53 respectively. The bottom soil pH concentration was lower in P-2 and P-3 compare to P-1. The pH of bottom soil can be monitored and liming materials applied when the pH is below 7.0 (Boyd and Tucker, 1998) [6].

Sugunan and Bhattachariy (2000) [17] while studying in detail about the beel of Assam, encountered the pH range of 6.70 to 7.83 and opined that it is ideal range for supporting good fish production. Thunjai (2002) [19] reported that tilapia ponds in

Changrai and Samutprakarn, Thailand had average soil pH of 7.43 and 7.50, respectively. The soil pH was between 6.63 and 9.40 in Changrai and 6.62 and 7.90 in Samutprakarn. Banerjea (1967) [3] suggested that the best pH range for pond soils is 6.5 to 7.5 while 5.5 to 8.5 is the acceptable pH range. Boyd and Musig (1981) [7] also pointed out that optimum pH for good health and high growth rate of freshwater animals in the range of 6.5 - 9.0. As, the optimum pH of soil for fish production is ranged from 6.5 to 7.3, therefore, from the above observation, it had been concluded that highly alkaline condition of pond soil is undesirable for production of fish as reported by Ahmed (2004) [1].

3.2 Organic Carbon

Table 4: Pond wise monthly variation in Soil organic carbon (%)

Months	P1(Station Road Pond)	P2(Tegharipara Pond)	P3(Gobinda Dighi pond)
JAN	2.43 ± 0.049	2.53 ± 0.035	0.94 ± 0.014
FEB	2.40 ± 0.021	2.65 ± 0.028	1.02 ± 0.141
MAR	2.50 ± 0.007	2.58 ± 0.028	0.94 ± 0.042
APR	2.50 ± 0.442	2.71 ± 0.014	1.4 ± 0.070
MAY	2.50 ± 0.044	2.79 ± 0.007	1.72 ± 0.077
JUNE	2.50 ± 0.160	2.76 ± 0.042	2.26 ± 0.049

In the present study the percentage of organic carbon varied from 2.43 (January) and 2.50% (April, May, June) in P-1, 2.53(January) to 2.79% (May) in P-2 and 0.029 (January) to 2.26% (June) in P-3 (Table. 4). The maximum average value (2.61%) was found in P-2 and minimum in P-3 (1.37%). The soil organic carbon was significantly highest ($p<0.05$) in June than other months in both P-1 and P-3. There was significant variation was found in between the months of May and June in P-1. In P-2 the maximum significant variation ($p<0.05$) was found in the month of May, but there was no significant variation ($p>0.05$) between the month of May and June. Banerjea (1967) [3] suggested an optimum organic carbon content to be ranging from 1.5 to 2.5% and above 2.5% as undesirable. According to Boyd (1995) [8], when soil pH is below 7.0 and organic carbon concentrations are above 2.5% (around 5% organic matter) within the S horizon, natural productivity that supports fish growth decreases in ponds. During the present study organic carbon content of sediment of the water bodies P-1, P-2 and P-3 were 2.47, 2.67 and 1.38% respectively.

4. Conclusion

So, from the overall study, it can be concluded that the health status of P-3 is significantly inferior. The reason may be due to high level of anthropogenic activity and poor maintenance of this water body. After studying all the parameters it can be concluded that the ecological condition of P-2 is better than P-1. The reason may be due to the better management practices like no idol immersion, no washing of utensils, clothes and vehicles etc. by the society's people. Further detailed analysis in different seasons involving other related parameters as well, will throw more light on the status of these ponds.

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