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Short Communication

# Limnological investigations of Texi Temple pond in district Etawah (U.P.)

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***Abstract:*** *Present investigations were carried out on the limnological aspects of Texi temple pond in district Etawah. Many of the parameters were found below the permissible limits for drinking water as suggested by WHO. A total of 18 parameters were analysed and their seasonal variations in the year 2003 were discussed.*

***Key words:*** *Limnology, Temple pond*

## Introduction

Limnological investigations on water bodies were aimed to assess the deterioration of water quality due to pollution. Several studies have been made on the limnology of fresh water bodies in India (Ganapathi, 1940; Alikunhi *et al.*, 1948; Harshey, *et al.*,1982; Rao and Mahmood, 1995; Alfred and Thapa, 1996; Naganandini and Hosmani, 1998; Patel and Sinha, 1998 ; Pandey *et al.*, 2000). To evaluate the water quality, an effort was made to present a comprehensive limnology of Texi temple pond in district Etawah, U.P.

## Materials and Methods

Texi temple is situated at the end of the city, one km. away from river Jamuna. The fresh water pond is more than 100 years old.

The pond is about five acre in area and with an average depth of about two metres during post monsoon period. The water of this pond is used by animals for drinking purposes. The pond is also used for bathing and washing by local residents. Samples of the water for physicochemical characteristics were analysed according to standard methods of APHA (1998) and Paka and Rao (1997).

Water samples were collected during morning hours in between 8.30 to 10.30 a.m. with one litre containers from the pond in three seasons. To study the water quality and its seasonal variations, the water samples are collected during summer, monsoon and winter seasons. Some of the results were recorded at the sampling sites whereas the others were recorded in the laboratory. The parameters observed were colour, pH, total dissolved solids, carbonates, bicarbonates, non carbonates, hardness, calcium, magnesium, sodium, sulphate, potassium, DO, free $CO_2$, BOD, COD, nitrate and phosphate. The colour of temple pond water was observed visually. Hydrogen ion concentration was determined with the help of BDH narrow range pH strips. Later on, to confirm the results the pH was also measured in the laboratory by the phillip's digital pH meter. Total dissolved solids was measured by 100 ml of water sample (filtered) dried on a hot plate in a pre weighed China dish. The China dish was then again weighed to calculate the total dissolved solids (TDS) per litre of sample by applying the formula

$$TDS = \frac{W_2 - W_1}{V} \times 1000$$

Where, $W_2$ = Weight of China dish after evaporating the total volume to dryness.
$W_1$ = Weight of empty China dish and
$V$ = Volume of sample evaporated to dryness.

Total hardness was measured by ammonia buffer and EDTA method.

## Results and Discussion

Physiochemical parameters of three seasons of 2003 are given in the Table 1 together with the maximum permissible limits for drinking water as prescribed by World Health Organization (WHO).

During the present investigation the values of hydrogen ion concentration of the Texi temple pond during the summer, monsoon and winter seasons were 6.95, 7.1 and 7.05 respectively. The variations of pH values during the study showed no remarkable significance. The highest value was noticed in monsoon season and lowest in summer season. Total dissolved solids of the pond was 120 mg/l in summer, which is the highest value and the lowest values was noticed in winter.

Absence of carbonates was noticed and the bicarbonate alkalinity varied from 20 to 60 mg/l in three seasons, during which minimum value was observed in winter season and the maximum in summer season. Larger quantities of bicarbonates during summer may be due to the liberation of $CO_2$

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**Table - 1:** Seasonal variations of physicochemical factors in Texi temple pond during 2003

| Parameters | Summer season | Monsoon season | Winter season | Drinking water standards as per WHO (Maximum permissible limits) |
|---|---|---|---|---|
| Colour (Hazen units) | 1 | 5 | 25 | 15 |
| pH | 6.95 | 7.1 | 7.05 | 6.5-8.5 |
| Total dissolved solids (mg/l) | 120 | 90 | 35 | 1000 |
| Carbonates (mg/l) | 0 | 0 | 0 | - |
| Bicarbonates (mg/l) | 60 | 30 | 20 | 000 |
| Chloride (mg/l) | 14 | 35 | 3.5 | 250 |
| Total hardness (mg/l) | 24 | 12 | 16 | 500 |
| Calcium (mg/l) | 6.4 | 3.2 | 6.4 | 200 |
| Magnesium (mg/l) | 1,92 | 0.96 | 0 | - |
| Sodium (mg/l) | 30 | 28 | 5 | 200 |
| Sulphate (mg/l) | 10 | 10 | 5 | 400 |
| Potassium (mg/l) | 1.0 | 1.0 | 1.0 | - |
| DO (mg/l) | 6.8 | 7.8 | 8.8 | - |
| Free $CO_2$ (mg/l) | 37.0 | 5.5 | 22.5 | - |
| BOD (mg/l) | 0.6 | 2.5 | 3.0 | - |
| COD (mg/l) | 1.2 | 3.8 | 8.5 | - |
| Nitrate (mg/l) | 0.36 | 0.31 | 0.08 | - |
| Phosphate (mg/l) | 0.051 | 0.039 | 0.031 | - |

in the process of decomposition of bottom sediments with resultant conversion of carbonates to bicarbonates.

Chloride values were found ranging between 3.5 to 35mg/l of which maximum value was noticed in monsoon and the lowest value in winter may be due to dilution effect in post monsoon period. Chourasia and Adoni (1985) also found similar behaviour of chlorides in their studies on Sagar lake with summer maxima and winter minima.

Total hardness value of the pond was 13 to 24 mg/l of which higher value was in summer while the lowest in monsoon season. The maximum premissible limit for this parameter for drinking water standards is 500 mg/l.

Calcium is found in greater abundance in all natural water as its main source is weathering of rocks from which it leaches out. Calcium was found in the same quantity and comparatively higher both in summer and winter seasons while lower in monsoon seasons. Munawar (1970) also noticed higher values of this parameter in these two seasons. Lower concentration of calcium could be attributed to bottom sediments. Magnesium values are poor. Calcium and magnesium play an important role in antagonizing the toxic effects of various ions in neutralizing excess acid produced (Munawar, 1970).

Sodium quantities varied between 5 to 30 mg/l with its summer maxima and winter minima. High sodium content in the form of chloride and sulphate makes the salty taste of water, making it unfit for human consumption but these three parameters were found in lower quantities indicating potability of the pond water.

Potassium content (1.0 mg/l) was also low in all the three seasons. Throughout the investigation period, high dissolved oxygen contents was noticed during winter season.

Carbon dioxide is one of the essential constituents of an aquatic ecosystem. The abundance of carbon dioxide exerts certain specific effects on aquatic bioata. The pond exhibited maximum carbon dioxide as 37.0 mg/l during summer whereas the lowest concentration of carbon dioxide (5.5 mg/l) was recorded during monsoon season. Cole (1975) noted that free $CO_2$ supply rarely limits the growth of phytoplankton. Alternately, the bicarbonates are utilized as a source of carbon by the photosynthetic activity of phytoplankton.

BOD is found to be more sensitive test for organic pollution. BOD value of pond water ranged between 0.6-3.0 mg/l. Highest BOD value was observed in winter season. Increased temperature and sedimentation load reduce BOD (Pyatkin and Krivoshein, 1980). The estimation of COD is of great importance for waters having unfavourable conditions for the growth of microorganism, such as presence of toxic chemicals (Saxena, 1994). COD value of pond water ranged between 1.2-8.5 mg/l. Highest COD value was observed in winter season.

The most important source of nitrates is biological oxidation of nitrogenous substances present in sewage, industrial wastes, chemical fertilizers, decayed vegetables, animal feed lots, leachates from refuse dumps, septic tank effluent, *etc.* High amounts of nitrates in pond water are indicative of pollution. The nitrates concentration of water lies in the range of 0.08-0.36 mg/l. Although all the samples have nitrate concentration with in the permissible limits prescribed by Bureau of Indian Standards, the presence of nitrates in the water samples is suggestive of some

bacterial action and bacterial growth. These findings support to the observations of several workers (Hussainy, 1967; Singh, 1991; Majumder *et al*., 2006).

It is evident from the present study that the phosphate concentration was higher during summer and lower in winter season. It was quite opposite in relation to dissolved oxygen and phytoplankton population. Many earlier workers have also reported similar findings (Marshal and Falconer, 1973; Meckenzie and Gillespie, 1986; Ghavzan *et al*., 2006).

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