

Analysis of some physico-chemical parameters of Bawan Bigha Pond of Chakrama, Mohanpur, Deoghar, Jharkhand, India

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ABSTRACT

Bawan Bigha Pond of village Chakrama, Mohanpur, district Deoghar, Jharkhand is a large perennial pond. The pond is used by the local inhabitants for various purposes like drinking, bathing, washing of clothes and cattle, fishing, irrigation of agricultural land. The pond is badly ignored, even the sewage and garbage are dumped into it.

The pond water is used by people of low to medium income group in their day to day life for various purposes ignoring its quality. The present study was conducted from the month of November, 2020 to January, 2021 to find out hydrobiological qualities of water.

Key Words - Bawan Bigha Pond, physico-chemical parameters

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INTRODUCTION

Pond represents a good source of fresh water, lentic, aquatic ecosystem. Water is the most important and unique substance quite essential for life. It is the most integral ingredient for the life of plants and animals.

The Bawan Bigha pond of village Chakrama, Block Mohanpur, Dist.- Deoghar, of Jharkhand is a large perennial pond having latitude 24.5N and longitude 86.8E, altitude 233m above sea level. It occupies an area of 52 Bigha i.e. 6.956 hectare (ha). The pond exists since 1840 owned by Rani Detwa Rajlakshamiswari having length of about 1000m, width 800m and depth 6.5m surrounded by Shashi Bhushan village and Mohanpur Bazaar in north, Chakrama and Talaria village in south, Trikut Pahar (mountain) in east and Mohanpur Bazaar road in west. Rain water and surface run-off of Trikut Pahar is the source of water to feed the pond. Its water is used for drinking, bathing, washing of clothes and cattle, irrigation, boating and fishing. Some poor villagers of the locality use pond water for cooking and drinking purposes which sometimes causes severe stomach disorder, diarrhoea, vomiting and

other water borne diseases. Indigestion is very common among the poor villagers. Fishermen put huge quantity of cow dung as the fodder for the faster growth of fish in the pond. Cow dung makes the water dirty and stinking which is unsafe for drinking and cooking.

Physico-chemical factors are important aspects of aquatic environment on the basis of which quality of water can be judged. Taking this view in mind, the present work was undertaken to assess some physico-chemical parameters of Bawan Bigha Pond which reflected valuable information of ecological and environmental interest.

MATERIAL AND METHODS

Samples from sub-surface water of the pond were collected in plastic bottles of 2 litres at 12.30 pm each month. The parameters were tested at research site where air and water temperature (by digital thermometer), pH (by a pHep Hanna-pH meter, TDS (by a digital instrument), Dissolved oxygen (DO), Free Carbon Dioxide (Free CO₂), Total alkalinity and other parameters were analysed in the laboratory. Standard methods of American

Public Health Association (APHA) 23rd Edition, 2017 was followed for the analysis of various abiotic factors (Table-1).

RESULTS AND DISCUSSION

The physico-chemical parameters of water determined during the study period are given in Table-1.

Table-1.

Parameters	Nov, 2020	Dec, 2020	Jan, 2021
Atm. Temp. (degree Centigrade)	31	22.4	27
Water Temp. (degree Centigrade)	26	21.5	19.98
pH at Atm. Temp.	8.1	8	7.9
TDS	123	108	111
Turbidity (in NTU)	4.6	3.0	4.6
Dissolved Oxygen (mg/l)	6.2	4.8	5.6
Free CO ₂ (mg/l)	8.0	8.0	4.0
CO ₃ (mg/l)	NIL	NIL	NIL
HCO ₃ (mg/l)	92	100	180
CaCO ₃ (mg/l)	198	144	100
Ca (mg/l)	52.8	30.72	28
Mg (mg/l)	15.84	16.12	7.2
Na (mg/l)	78	72	66
SiO ₂ (mg/l)	5.62	3.51	1.41
PO ₄ (mg/l)	<0.15	<0.15	<0.15
SO ₄ (mg/l)	3.78	5.16	10.50
NO ₃ (mg/l)	2.03	<0.5	2.18
Cl (mg/l)	53.81	24.63	20.27
BOD (mg/l)	5.4	5.4	5.6
COD (mg/l)	39.2	58	39.2

Air Temperature

Temperature is a variable factor which is influenced by time, season, latitude, altitude, slope direction, soil texture, plant cover and human activities. Air temperature showed noticeable fluctuation from maximum of 31 degree centigrade in Nov to minimum of 22.4 degree centigrade in Dec. This agreed with the findings of Patralekh & Patralekh (2010) in the pond of Deoghar, Jharkhand, India.

Water Temperature

Water temperature and its seasonal fluctuations play a great role on the thermal feature and productivity of the water body. The solubility of gases in water varies inversely with temperature. During the study period, the maximum and minimum water temperature varied from the maximum of 26 degree centigrade in Nov to the minimum temperature of 19.98 degree centigrade in Jan. Similar results were also found by Ghosh (2018).

pH

The pH indicates alkalinity and acidity of water. pH was observed 8.1 in Nov and 7.9 in Jan. These findings showed similarities with the findings of Sayeswara *et al.* (2011) for Hosahalli pond, India and with Jipsa *et al.* (2013) for a lentic water body, India. Present findings were within the range (6.5 - 8.5) of WHO (2011).

Total Dissolved Solids (TDS)

Dissolved solids are very common in natural water. During the study period, TDS varied from 123 mg/l to 111 mg/l during Nov to Jan but it was within the standard limit (500 mg/l) of ICMR (1975)/ BIS (1983). According to WHO (2011), water is suitable when the TDS value is below 600 mg/l but is unpalatable when the TDS value is above or exceeds 1000 mg/l. Similar results were observed by Barua and Kakati (2012) in a fresh water pond in Assam, India.

Turbidity

Turbidity is the status of water in respect of suspended particles in water. Suspended particles make the water turbid and opaque. The lowest turbidity has been noted Dec i.e. 3.0 NTU and maximum of 4.6 NTU in Jan.

Dissolved Oxygen (DO)

In aquatic habitat, the source of oxygen is atmosphere, rainfall and aquatic plants. Oxygen is important to judge the quality of water. During the month of Nov, it was maximum of 6.2 mg/l whereas the minimum was recorded in Dec of 4.8 mg/l. The higher reading Nov may be attributed to rippling, turbulence, water current and wind velocity which

supports the report of Mohanti and Padhi (1984).

Free Carbon Dioxide (free CO₂)

The source of free carbon dioxide (free CO₂) in water body is atmosphere, rainfall and respiration by aquatic animals. During the study period, free CO₂ was 8 mg/l in Nov -Dec and 4.0 mg/l in Jan. Similar range was observed by Sayeswara (2011) in Hosahalli Pond, Karnataka, India.

Alkalinity

Presence of carbonates, bicarbonates and hydroxides in water is the most common cause of alkalinity in natural water. The concentration of mainly carbonate and bicarbonate in the water, that is responsible for buffering capacity, is the total alkalinity of a waterbody. The amount of HCO₃ during the study period varied from 92mg/l in Nov to 182mg/l in Jan. The amount of CaCO₃ varied from 198 mg/l in Nov to 100mg/l in Jan. In pond, the desirable range of alkalinity as CaCO₃ is considered as 50-150 mg/l but above 20mg/l and below 400mg/l is the acceptable range which is supported by Stone and Thomforde (2004). The value of alkalinity was within the permissible (600mg/l) limit of WHO.

Total Hardness (TH)

Hardness is the total soluble Ca⁺⁺ and Mg⁺⁺ salts present in water expressed as CaCO₃ equivalent. From the table, the amount of Ca was in the range of 52.8-28mg/l and that Mg was in the range of 15.84-7.2mg/l. The decreasing trend may be for the reason of decreasing use of soap for domestic washing and bathing purposes. On the basis of hardness, Kiran (2010) classified the water body as soft (0-75mg/l), moderately hard (75-150mg/l), hard (150-300mg/l) and very hard (above 300mg/l). On the basis of this, classification, the water of the pond was soft throughout the study period.

Sodium (Na)

Sodium stems from rock and soil and naturally ends up in water. Concentration of sodium depends on geological condition and wastewater contamination. Sodium is dietary mineral for fish. Plants hardly contain any sodium. In the pond, the amount of sodium varied from 78 mg/l in Nov to

66 mg/l in Jan is well within the normal range. High quantity of sodium metal in water reacts exothermically with water.

Silicate (SiO₂)

Silicate is an important parameter of aquatic environment. It acts as structural constituent of diatoms. It fluctuates between 5.62 mg/l in Nov to 1.41 mg/l in Jan. Decreasing trend of silicate in the pond water may be for the reason of low temperature and sedimentation of suspended particles which supports the report of Saha (1983) and Pandit (1986).

Phosphate(PO₄), Sulphate(SO₄) and Nitrite(NO₃)

Phosphorus is the essential element and Sulphur is the essential nutrient for plant. Nitrites have the same effect on aquatic plant as phosphates. Phosphates come from uneaten food, dead fish, decaying plants. Low level of phosphates does not harm fish, plants and invertebrates, high level of phosphates leads to algae bloom. PO₄ was <0.15 mg/l throughout the study period. The most common form of Sulphur in well oxygenated water is sulphate (SO₄). When sulphate is <0.5mg/l, algal growth will not occur. Recommended limit for water use for domestic purpose is below 250mg/l. In this pond, SO₄ was in the range of 3.78-10.50 mg/l during the study period which is within the safe limit for domestic use. High level of nitrites (NO₃) endangers the life of aquatic insects or fish to survive. Algae and other plants use nitrites as a source of food. High level of nitrites in water causes fluctuation in dissolved oxygen which depletes oxygen causing death of other organisms such as fish. The NO₃ level in the pond was in the range of <0.5 mg/l in Dec to 2.18 mg/l in Jan.

Chloride

Chloride metabolically depicts pivotal role in photolysis of water and phosphorylation in autotrophs. It is considered as pollution indicator when present in high concentration. It fluctuated from 53.81 mg/l in Nov to 20.27 mg/l in Jan. Dumping of sewerage, organic matters of animal origin, impression of mud made painted idols and human activities might be the possible reason of greater chloride in Nov.

Biochemical Oxygen Demand (BOD)

Biochemical Oxygen Demand refers to the quality of oxygen required by bacteria and other microorganisms in the biochemical degradation and transformation of organic materials under aerobic condition. During the study period, BOD was 5.4 mg/l in Nov, Dec and 5.4 mg/l in Jan. According to Ekubo and Abowei (2011), the BOD level between 1.0 to 2.0 mg/l is considered clean, 3.0 mg/l fairly clean, 5.0 mg/l doubtful and 10.0mg/l definitely bad and polluted. In this context, BOD of the pond was doubtful and polluted.

Chemical Oxygen Demand (COD)

Chemical oxygen demand quantifies the amount of organics in water. It determines the effect of the effluent on the receiving body. It also quantifies the amount of oxidizable pollutants found in surface water of the pond. COD of the pond was 58 mg/l in Dec whereas it was 39.2mg/l in Nov and Jan.

CONCLUSION

The pond water should not be used for domestic purposes of drinking as discharging the household waste materials, cleaning utensils, surrounding runoff and high use of detergent in washing clothes make the pond water contaminated.

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