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Study the physico-chemical analysis of pond water of Bhopal, where macrophytes are surviving

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Abstract
This study determined and characterized the quality of water of Jawahar Baal Udhyaan Lake of Bhopal. The research involved the levels of physico-chemical properties of Lake Water samples. About 40% of the pH values were below the WHO recommended minimum allowable value of 6.5 whiles most of the physical parameters fell within the recommended values of WHO. In general, the water quality of the studied lakes can be said to be fairly good with respect to the monitored elements and Thus, on the basis of the physico-chemical studies, it can be said that the study of Jawahar Baal Udhyaan Lake in Bhopal district is nutrient rich and suitable for aquatic organisms. Slight alkaline medium and high amount of nutrients provide favorable conditions for aquaculture.

Keywords: water analysis, hardness, COD, BOD etc.

Introduction
A pond is referred to as a man-made or natural water body which is between 1 m2 and 2 ha (~5 acres or 20,000 m2) in area, which holds water for four months of the year or more (Ehiagbonare JE and Ogunrinde OY, 2010) [4]. In human health, water has a profound influence and quality of the water supplied is important in determining the health of individuals and whole communities. Safe water quality is a major concern with reference to public health importance as health and well being of the human race is closely tied up with the quality of water used.

Fresh water is finite resource, essential for agriculture, industry and even human existence, without fresh water of adequate quantity and quality, sustainable development will not be possible (Rajiv P *et al.*, 2012) [13].

The water is one of the most important compounds of the ecosystem. Living things exist on the earth because of this is only planet that has the existence of water. It is necessary for the survival of all living things be it plant or animal life. It is the most abundant commodities in nature but also the most misused one. Although earth is a blue planet and 80% of earth's is covered by water, the hard fact of life is that about 97% of its locked in oceans, sea which is too saline to drink and for direct use for agricultural or industrial purposes. 2.4% is trapped in polar icecaps and glaciers, from which icebergs break off and slowly melt at sea. < 1% (i.e. 33, 400 m3) water is present in ponds, lakes, rivers, dams etc. which is used by man for Industrial, domestic and agricultural purposes (Shrivastava S and Kanungo VK, 2013) [16].

The main objective of this work has to analyze various physico-chemical parameters of the surface water of Jawahar Baal Udhyan Pond, Bhopal.

Materials & Methods
Sampling Sites
The Jawahar baal udhyaan lake, Bhopal Was subjected to physico-chemical analysis. The main criteria for the selection of reservoir were, it should be approachable and water quality should be best for aquaculture, drinking and irrigation. This sampling stations are located in the centre of Bhopal.

Sample Collection
Samples were collected in the different seasons. 125ml glass bottles were used to collect and fix samples for estimation of all physico-chemical parameters. Samples were collected in triplicate from for analysis of water parameters.

Analysis
The samples thus collected were analyzed for a number of physico-chemical parameters employing standard methods (APHA, 1998) [2]. The parameters include pH, Temperature, Dissolved Oxygen (DO), COD, Total Hardness, Total Solids (TS), Total Dissolved Solids (TDS), Alkalinity, BOD, Chloride ion etc.

Results & Discussion
The physico-chemical parameters obtained from analysis of water samples of Jawahar Baal Udhyan, Bhopal (M.P.), India during the study period are presented in Table 1.

Table 1: Physico-chemical analysis of water of Jawahar Baal Udhyan Lake, Bhopal at different season

Parameters	Aug-Oct. (S.M. and S.D.)	Dec-Feb (S.M. and S.D.)	April-June (S.M. and S.D.)
Temperature (°C)	20 ± 0.48	18.33 ± 1.78	26.33 ± 0.69
pH	7.2 ± 0.22	6.76 ± 0.43	7.10 ± 0.24
DO (mg/L)	1.04 ± 0.71	8.10 ± 1.11	7.45 ± 0.72
BOD (mg/L)	5.58 ± 0.45	2.99 ± 0.99	4.02 ± 0.98

TDS (mg/L)	76.50 ± 10.25	68.50 ± 7.0	51.50 ± 4.43
COD(mg/L)	6.1813 ± 0.25	3.95 ± 0.62	5.03 ± 0.56
Total Alkalinity (mg/L)	298.66± 4.57	114.50 ± 20.34	90.75 ± 10.59
Hardness (mg/L)	126.6± 0.25	114.5± 0.61	170.7± 0.42

Water is one of the abundantly available substances in nature, which man has exploited more than any resources for the sustenance of life. Water of good quality is required for living organisms (Shinde *et al.*, 2011) [15].

In the present investigation atmospheric temperature varied from 18.33°C to 26.06°C (Table. 1). During the experimental period maximum temperature was found in summer season (April-June) and minimum in winter (Dec. to Feb.) (Fig 1). Rise in temperature speed up the biochemical reactions and reduce the solubility of gases. Temperature of running water usually varies seasonally and daily and among locations due to climate, elevation, and extent of streamside vegetation and the relative importance of ground water inputs (Singh, 2010) [17]. The average of Temperature of water samples in the study area was 25±2.0ºC. There was a significant difference in temperature in seasons in the water bodies under the study. Verma *et al.*, 2012 [19] done same work on pond located near Nandani Mines in Durg District Chhattisgarh, India. Present study is in agreement for these findings. The EPA, Ghana (1997), stipulates that water for drinking and domestic purposes should have a temperature not exceeding 30˚C.

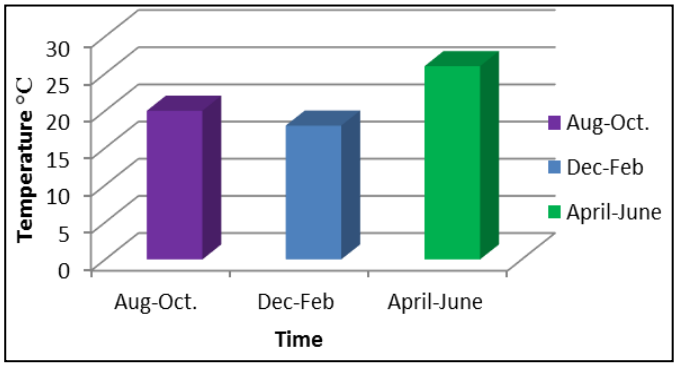

Fig 1: Temperature of pond water in different season

pH is considered as an important ecological factors and is the result of the interaction of various substances in solutions in the water. It is the scale of intensity of acidity and alkalinity of water and measure the concentration of H+ ions. In the present investigation, the pH has recorded between 6.7 to 7.2 in Jawahar Baal pond (Fig 2). Kamat *et al.*, (2006) [7] reported the pH values between 6.7 to 8.1 in Hosalli tank in Shimoga district of Karnataka. Kataria *et al.*, (1996) [8] observe the pH values between 7.2 to 8.2, stated that maximum pH in the months of May indicates high rate of photosynthesis. Similar results are found in the present study. Lendhe and Yergi (2004) [10] observed the pH 7.2 to 7.8 in Phirange Kharbav lake of Thane district, Maharashtra. In the present investigation the maximum pH was reported during summer seasons and minimum during winter.

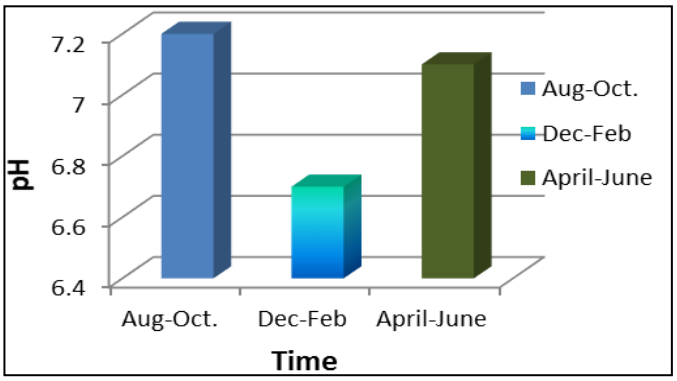

Fig 2: pH of pond water in different season

The TDS in water is due to the presence of Calcium, Magnesium, Sodium, Potassium, Bicarbonate, Chloride and Sulphate ions. As prescribed limit of TDS for drinking water is 500 mg /l. Davis and Dewiest, (1966) stated that the TDS concentration of fresh water generally ranges between 192-1280 mg/l. Total Suspended Solids in the study area was maximum in monsoon 76.50 ± 10.25 mg/l. (Fig 3), which are below from standard limit of 600mg/l. Total Suspended Solids in the study area was 186.2±2.3 mg/l. which is below from standard limit. Devaraju *et al.*, 2005 [3] has made similar observations in Maddur Lake and Garg *et al.*, 2006 [5] has also made similar observations in Ramsagar reservoir.

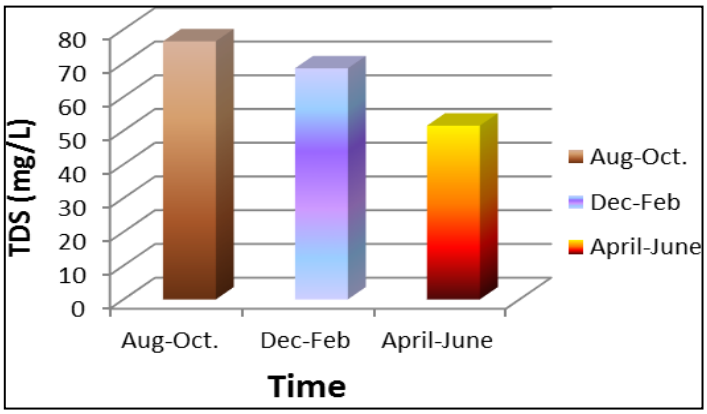

Fig 3: TDS of pond water in different season

In the present investigation the values of dissolve oxygen recorded ranges between 1.04 ± 0.71mg/L to 8.10 ± 1.11 mg/L in Jawahar Baal Udhyan Pond (Fig 4 & Table 1). The maximum dissolve oxygen was recorded during the winter and minimum during the monsoon season. High values of dissolve oxygen during winter seasons was due to low temperature and high photosynthetic activities and low values of dissolve oxygen was due to high temperature and high rate of oxidation of organic matter. The variation of DO in water depends upon the temperature of the water body, which influences the oxygen solubility in water. A good water quality should have solubility of oxygen 7.6 mg/l and 7.0 mg/l at 30˚C and 35˚C respectively (Toufeek *et al.*, 2009) [18]. Rani *et al.*, (2004) [14] was also reported lower values of Dissolved oxygen in summer season due to higher rate of decomposition of organic matter and limited flow of water in low holding environment due to high temperature.

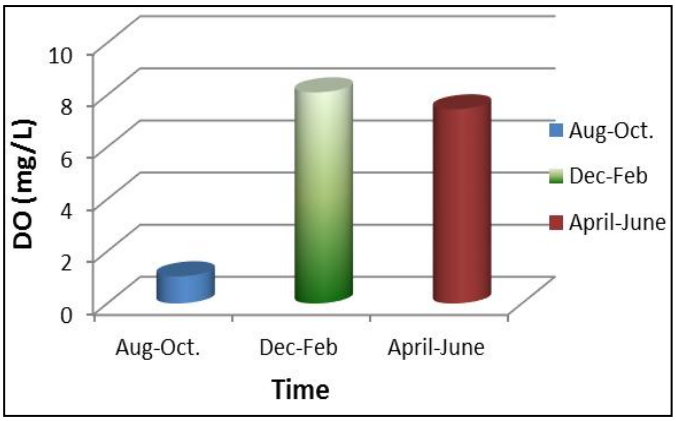

Fig 4: DO of pond water in different season

The low BOD value of water showed good sanitary condition of the water. In the present study, BOD was around 3. 58±1.0 mg/l. The BOD value was obtained maximum due to high temperature. The BOD test measures the oxygen demand of biodegradable pollutants whereas the COD test measures the oxygen demand of oxidizable pollutants (Admoroti, 1996) [1]. Unpolluted waters typically have BOD values of 2mg/l or less. The normal range of BOD for good water quality is 5-6 mg/l (Huq and Alam, 2005) [6].

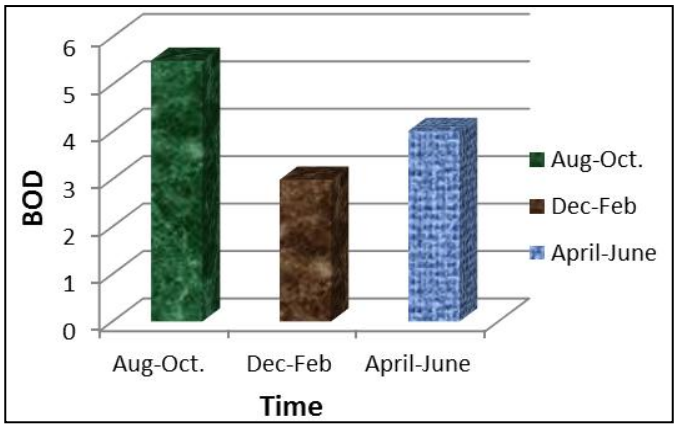

Fig 5: BOD of pond water in different season

In the present investigations, the total hardness value was maximum during summer and minimum in winter season (Fig 6). Kataria *et al*., (1996) [8] also recorded maximum value of total hardness in summer, moderate in monsoon and minimum in winter at Kolar reservoir in Bhopal, Madhya Pradesh. Magnesium is one of the main constituents in natural water is vital components of chlorophyll. In the present investigations the total hardness was recorded in the range of 114.5± 0.61mg/L. to 170.7± 0.42 mg/L in the pond.

Patil *et al.*, 2011 recorded maximum calcium and magnesium hardness during winter season from Pitamahal dam from Rourkela. Mohanta and Patra (2010) [12] observe the maximum value of magnesium during summer and minimum during winter in the river Sanamahhakandana at Keonijhar Garh.

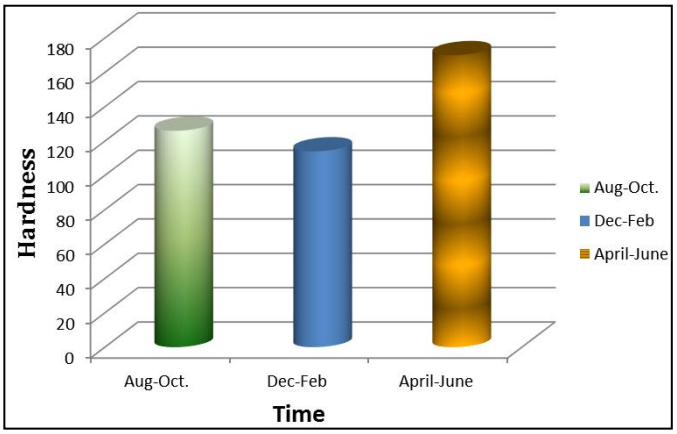

Fig 6: BOD of pond water in different season

The observation of alkanity was recorded maximum 298.66± 4.57 in monsoon and minimum in summer 90.75 ± 10.59. In the present investigation, maximum values of alkalinity during monsoon may be due to household detergents products added in the pond only in monsoon season due to flooding of city channels after their saturations in summer and minimum values during winter and summer is be due to use of bicarbonates by the pond biota directly for their load which leads to the depletion of bicarbonates in water resulting in low values of total alkalinity. Hujare, 2008 is also reported similar results that it was maximum in summer and minimum in winter due to high photosynthetic rate. Moderately alkaline

water (less than 350 mgCaCO3/l) in combination with hardness forms a layer of calcium or magnesium carbonate that tends to inhibit corrosion of metal piping (Krishnan R *et al.*, 2007) [9].

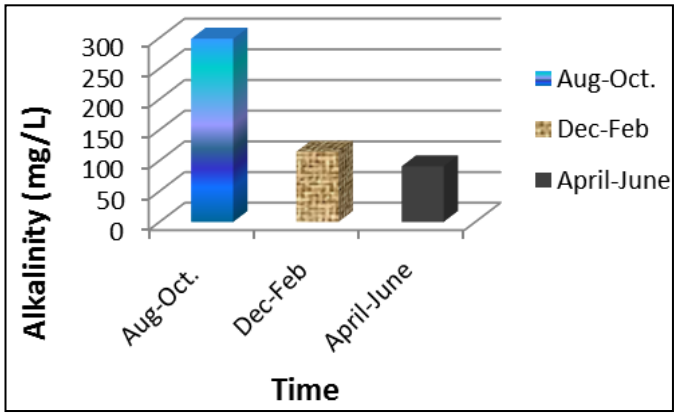

Fig 7: Alkalinity of pond water in different season

COD is the oxygen required by the organic substances in water to oxidize them by a strong chemical oxidant. The observed value of COD in samples were between the range of 3.95 ± 0.62 to 6.1813 ± 0.25 mg/l Table 1 & Fig 8. In the present investigation, maximum chemical oxygen demand was recorded during the monsoon and minimum during the summer season.

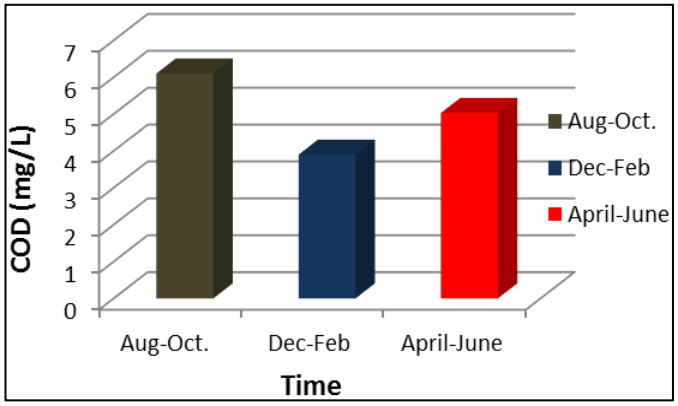

Fig 8: COD of pond water in different season

Conclusion

The study assessed the evolution of water quality in pond water of Jawahar Baal Udyan, Bhopal. A comparative study of pond water was carried out by taking certain important parameters like temperature, pH, total suspended solid, total dissolved solid, alkalinity, dissolved oxygen, chemical oxygen demand. In this present investigation it was found that the maximum and minimum parameters were not at the level of pollution. It can be said that the comparative study of water from Lake View drive and Jawahar Baal Udhyaa Lake in Bhopal district is nutrient rich and suitable for aquatic organisms.

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