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ORIGINAL ARTICLE

Analysis of Physico–chemical characteristics of a very old pond in the campus of B.R.A. Bihar University, Muzaffarpur (Bihar) INDIA

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ABSTRACT
A man made or natural water body is known as a pond. Fresh water is essential for the existence of life. The quality of water depends upon physico–chemical and biological characteristics which reflect on biotic status of the ecosystem. During present investigation, the analysis of physico–chemical characteristics of water of a very old pond situated in the campus of B.R.A. Bihar University, Muzaffarpur (Bihar) was studied during March, 2015 to February, 2016. This is evident from the findings that air and water temperature were maximum (34.32^{0}C and 30.20^{0}C respectively) during summer, pH value of water was maximum (8.5) during summer, dissolved oxygen was maximum (9.6 ppm) during rainy season, free CO_2 was maximum (15.50 ppm) during summer, transparency was maximum (36.20 cm) during winter, total dissolved solids was maximum (178 ppm) during rainy season, BOD was maximum (2.88) during rainy season, total hardness was maximum (117 ppm) during summer and total alkalinity was observed maximum (226 ppm) during rainy season. It was also observed that due to various activities of people, this water is not suitable for consumption.
Keywords : *Bihar University, Muzaffarpur, pond, Physico–chemical, parameters*

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INTRODUCTION

Ponds are important waterbodies located in and around human habitations as they are generally semi natural ecosystems constructed by man in landscape suitable for water stagnation. The quality of water depends upon physic–chemical and biological characteristics which reflect on biotic status of the ecosystem. Life in aquatic environment in mainly regulated by physico–chemical characteristics and their stability. Due to uncontrolled increase in human population,urbanization and industrilisation these water bodies are under tremendous pressure owing to their overuse on one hand and enrichment due to nutrients and organic matter on the other, leading to the cultural eutrophication. WHO [15], 1995 reported that contaminated water, inadequate sanitation and poor hygiene cause 80% of diseases in developing countries. The concentrations of physico–chemical parameters increases due to human activities and also by lack of consciousness and environmental regulations. The present investigation was carried out to evaluate the physico–chemical characteristics of a very old pond situated in the campus of B.R.A. Bihar University, Muzaffarpur (Bihar). It was observed that the water of this pond was not suitable for consumption due to various activities of human being. The selected physico–chemical parameters analysed during investigation (March, 2015 to February, 2016) were air temperature, water temperature, pH, dissolved O_2, free CO_2, transparency, total dissolved solids, BOD, total alkalinity and hardness.

MATERIALS AND METHODS

Samples were collected for a period of one year (March, 2015 to February 2016). The sampling period was divided in three seasons–summer (March to June), Rainy (July to October) and winter (November to February). The sampling was done during morning hours (9–10 a.m.). The water samples for physico–chemical analysis were collected in five litre plastic jars from different corners of the pond. The selected

physico–chemical parameters during investigation were temperature (air & water both), pH, dissolved oxygen, free CO_2, Sacchi disc transparency, total dissolved solids, Biological oxygen demand, total hardness and total alkalinity. The physico–chemical analysis of the water samples were done according to APHA [1].Instruments and methods employed in analyzing physico–chemical factors of water is listed in Table–1.

Table–1 : Instruments / methods used for physico–chemical analysis of water sample

Parameter	Instrument / method used
Temperature	Thermometer
pH	pH meter
Dissolved oxygen	Dissolved oxygen meter
Free CO_2	Carbondioxide meter
Total dissolved solids	Conductivity / TDS meter
BOD	BOD Analyser
Total hardness	EDTA Titration
Total Alkalinity	Neutralising with standard HCl (Titration)

RESULTS AND DISCUSSION

The morphological characteristics of the pond studied in present investigation are summarized in Table–2. The parameter wise results are discussed here :–

Table–2 : Physico–chemical parameters of water of B.R.A.B.U. Pond, Muzaffarpur(March 2015–February 2016)

Physico–chemical parameters	Summer	Rainy	Winter
Air temperature (0^0C)	34.32	29.60	27.20
Water Temperature (^{0}C)	30.20	27.10	25.10
pH	8.50	8.00	7.80
Dissolved oxygen (ppm)	8.70	9.60	9.40
Free CO_2(ppm)	15.50	14.20	12.10
Sacchi disc transparency (cm)	29.50	30.20	36.20
Total dissolved solids (ppm)	164	178	153
BOD (ppm)	2.84	2.88	2.18
Total hardness (ppm)	117	96	104
Total alkalinity	194	226	206

TEMPERATURE

Temperature plays very important role in aquatic environment and considered as an important factor in controlling the functions of aquatic ecosystem [14, 3, 11]. In the present study, air and water temperature have been observed. The air temperature varied from 27.20 to 34.32 while the water temperature ranged between 25.10 and 30.20 ^{0}C. It was maximum during summer and minimum during winter. It was observed that the water temperature is influenced by air temperature. Sonawane *et al* [13] also reported similar results.

pH

pH works as an index of general environmental condition. The pH value of the pond shown alkalinitythroughout the year. The pH ranged between 7.80 to 8.50. The maximum pH was observed during summer months. According to Jhingran, 1982 the alkaline pH is suitable for fish culture. The microbiological integrity of water also depends upon its pH value [2].

DISSOLVED OXYGEN

Dissolved oxygen is an important parameter for water quality. It also serves as anindicator of the physical, chemical & biological activities of the water body. During investigation the minimum value of DO_2 of water (8.70 ppm) was recorded during summer months while maximum (9.60 ppm) during rainy. Excess temperature reduces the solubility of oxygen. Further, higher temperature also increases the decomposition rate and lower the oxygen. Prasad *et al*, [9] also observed same result.

FREE CO_2

Free CO_2 in water body is generally derived from the atmospheric sources, biotic respiration, decomposition of organic matter etc. According to the present investigations free CO_2 ranged between 12.10 to 15.50 ppm. Maximum free CO_2 was observed during summer, while minimum during winter. The highest value of CO_2 in summer months might be due to decomposition of organic matter by microbes. The present findings is very close to that of Singh and Singh [10].

SACCHI DISC TRANSPARENCY

Water transparency suggested the energy relationship at different trophic levels. It was minimum (29.50 cm) during summer and maximum (36.20 cm) during winter. Sinha *et al* [12] observed same results.

TOTAL DISSOLVED SOLIDS

Dissolved solid substances influence the taste, hardness and corrosive property of water. Dissolved solids in water include organic salts and small amount of organic matter. In present investigation the amount of dissolved solids ranged between 153 ppm – 178 ppm. The highest value of TDS during rainy season may be due to the effect of domestic waste, garbage, sewage etc. discharged in pond. According to Karthikeyan et al (2002), the higherconcentration of TDS adversely affects the quality of water and it is unsuitable for many purposes including irrigation & consumption.

BOD

BOD (Biological Oxygen Demand) is one of the most important parameters as it reflects the status of aquatic pollution. BOD ranged between 2.18 – 2.88. It was recorded maximum during rainy season due to input of organic wastes and increased activity of bacteria.

TOTAL HARDNESS

The total hardness of water is caused by carbonates, bicarbonates, sulphates, chlorides and nitrates of calcium and magnesium ions. In present investigation maximum value of total hardness (117 ppm) was observed during summer and minimum (96 ppm) during rainy season. Kumar, [7] and Hulyal & Kaliwal, 2011 also observed same results. Kiran (2010) reported that water can be categorized according to degree of hardness as soft (0–75 ppm), moderately hard (75–150 ppm) and hard (150–300 ppm). Thus the water of the present pond is moderately hard.

TOTAL ALKALINITY

Total alkalinity of water is due to the presence of mineral salts. It is due to carbonate and bicarbonate ions. Total alkalinity was observed maximum (226 ppm) during rainy season and minimum (194 ppm) during summer. According to Padma and Perlakali, [8], increase in total alkalinity during rainy season is due to input of water and dissolution of calcium carbonate ion in water column.

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