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Assessment of Physico-chemical Properties of Different Water Reservoirs of Barishal City, Bangladesh

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ABSTRACT: There are many man-made water reservoirs found in Barishal City. This study was aimed to assess the existing condition of physico-chemical properties of four different water reservoirs, namely Bibir Pukur (pond), Amtala Lake, Choumatha Lake and City Corporation Pond of Barishal City of Bangladesh. To evaluate the physico-chemical properties, the average of the parameters such as water temperature, total dissolved solids, electric conductivity (EC), pH, salinity, as well as depth, color, and transparency of water were analyzed. The highest average water temperature was found in the City Corporation Pond, which determined as 31.77±0.09 °C. Electric conductivity (ms/cm) and total dissolved solids (ppm) of Amtala Lake were 0.413 ±0.009 and 199±1.15. The highest average pH 7.88±0.01 and lowest salinity 140±1.73 were found in City Corporation Pond and Choumatha Lake respectively. The water depth of Bibir Pukur was 260.33± 13.98 cm which is the highest among the four water reservoirs. The highest values of dissolved oxygen and phosphate were 2.03±0.12 mg/l and 294.12±3.92 µg/l.

Keywords: Barishal City, Physico-chemical, properties, Man-made reservoirs, Water.

Bangladesh is a country of rivers and different types of water reservoirs. Rivers and water reservoirs are source of the fertility of land of Bangladesh (1). The water reservoirs of Bangladesh also show fertility for the aquatic ecosystem (2). This aquatic ecosystem included rivers, artificial lakes, natural lakes, man-made reservoirs for water, wetlands, streams, swamp forests, shallow, canals, seasonal water body, and low-lying flood plains. Rivers, ponds and lakes are the mostly considering waterways of strategic significance around the world (3). These waterways play important roles in supplying water for household work, commercial and crop production purposes. The life on earth depends on the water, and it contains different types of ions which are important for the different types of life forms (humans, plants, animals, microbes and aquatic organism, etc.). This outstanding property of water is often observed to the impossibility to require in water in its pure type (4). The growth, development and productivity of aquatic organism depends on the availability of adequqte nutrients. The physico-chemical properties of water body indicates the availability of nutrients (5,6). These physico-chemical parameters refer to the temperature, water turbidity, odour, colour, total solids,

total dissolved solids, total suspended solids, pH, conductivity, iron contents, acidity, total hardness, and chloride contents (7). To maitain the the aquatic system, analysis of water quality is very important (8). The physico-chemical properties usually maintain the standard of water quality (9). However, standard quality of water indicates the suitability of water for the aquatic lives, plants, and animals. Normally, water quality degrades due to the pollution, and this type of degrading water quality interrupted the physico-chemical properties of different water bodies. These properties are changeable due to changes in seasons in Bangladesh (10).

Nowadays, the physico-chemical properties of water are altered due to the accumulation of large quantities of hazardous contaminants, such as heavy metals from industrial waste, inorganic & organic pollutants in the soils of water reservoirs (11). Bibir Pukur, Amtala Lake, Choumatha Lake (C Lake), and City Corporation Pond (CC Pond) are four important water reservoirs of Barishal City, Bangladesh. These four water reservoirs are the centre point of all the development of Barishal city.

The main intention of the current survey was to document the elemental parameters of Bibir pukur, Amtala Lake, Choumatha Lake and City Corporation Pond; because these sites have not been studied earlier. The study of the elemental properties of Bibir pukur, Amtala Lake, Choumatha Lake and City Corporation Pond help to the establishment of a sustainable structure for the aquatic ecosystem. This study will also assist the development of the social and economic status of the local individuals.

MATERIALS AND METHODS

Study area

The study was carried out within four different fresh-water reservoirs located in Barishal city area. Among them, Bibir Pukur located in between latitude 22°44'10" N and line of longitude 90°22'15" E at sadar road of Barishal City. Moreover, Amtala Lake located at Amtala Mor in line of latitude 22°41'20" N and longitude 90°21'22" E; Choumatha Lake located at Choumatha, in line of latitude 22°42'07" N and longitude 90°21'10" E; City Corporation Pond located beside city corporation building in line of latitude 22°42'06" N and longitude 90°21'10" E in the same city (Figure 1).

Collection of samples

This study was carried out from August 2020 to October 2020. For the collection of samples pre-washed plastic bottles were used. Sample water was again used for washing the bottles. The bottles were tightly closed and then dipped, depth of dipping 0.5 m, in the lakes and ponds. Bottles were opened in the water for collection samples and then closed again. The samples were collected from three different points with three replications of each sampling site.

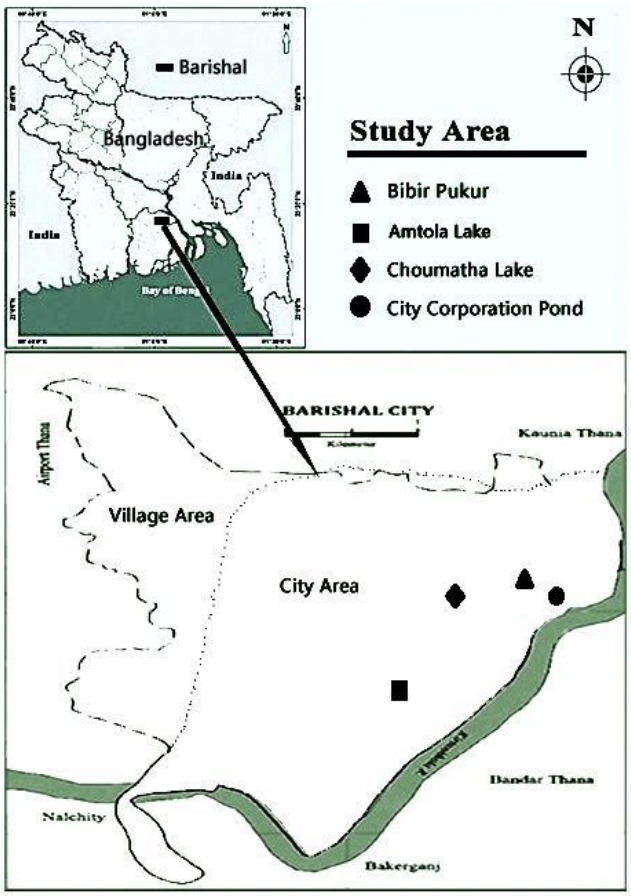

Figure 1. Map of Barishal City showing location of the four studied water reservoirs. Borders and positions are best approximate in the map.

Physico-chemical parameters

Samples were collected to analyze the elemental properties of the lakes and ponds water. Samples were collected in between 07.00 A.M to 09.00 A.M. The measured parameters were water temperature, pH, electric conductivity, water colors, transparency, salinity and total dissolved solids that were analyzed. The parameters like water temperature, color, transparency and depth were recorded on site immediately after collection. The water temperature was documented with the support of a Centigrade thermometer. The color of water was documented

counting on eye distinction. A rope and a meter tape were used for the measurement of depth of water. For recording transparency, Secchi disc was used. The other properties were analyzed after bringing the samples to the MS laboratory of the Department of Botany, University of Barishal. With the help of Pocket multiparameter (HANNA Instruments, model: DiST4, HI98304, made in Romania), the electric conductivity was measured. Moreover, with the help of another Pocket multiparameter counter (HANNA Instruments, model: HI98108. made in Romania), pH of the water was determined. Portable Dissolved Oxygen meter (DO meter, Model DO30) was used for the measurement of dissolved oxygen of the water and the amount of phosphate measured by following method-

Preparation of standard: About 0.220 g of solid KH_2PO_4 was used to prepare 300 ppm solution into a 500 ml volumetric flask. Then 200, 250, 500 ml phosphate solution were made from 10 ml of the standard phosphate solution in a 1 L volumetric flask each. Finally, 15, 12, 6 and 3 ppm solution were produced from the 10 ml of standard phosphate solution.

Preparation of complex: About 100 ml of water was used to dissolve 5 gm ammonium molybdate in a 500 ml volumetric flask. Then carefully 160 ml of concentrated sulfuric acid was added very slowly in the ammonium molybdate solution. The solution was mixed with water to form 500 ml volume. In a 150 ml conical flask, 20 ml of water, 10 ml of sample, 2ml of molybdate solution, and a spatula of ascorbic acid crystals was added. Then this solution was boiled till a deep blue/green color was developed, and then cools it. For all the standards, this procedure was repeated. Finally, spectrophotometric analysis was conducted using T-60 UV/Vis spectrophotometer, and as a blank distilled water was used.

RESULTS AND DISCUSSION

The water samples were taken from four totally different water reservoirs of Barishal City to analyze. The analyzed properties were temperature, pH, electric conductivity, total dissolved solids, salinity, water color, depth and transparency of water.

Table 1. Average of water temperature, electric conductivity, total dissolved solid, pH in in the four reservoirs.

Location	Temperature (°C)	EC (ms/cm)	TDS (ppm)	P^H
Bibir Pukur	31.16±0.08	0.343±0.003	161±0.58	8.32±0.01
Amtala Lake	30.56±0.06	0.413±0.009	199±1.15	8.19±0.01
Choumatha Lake	30.6±0.06	0.353±0.003	168±0.57	8.38±0.02
CC Pond	31.77±0.09	0.380±0.011	179.66±0.88	7.88±0.01

Table 2. Average of water salinity, water depth, water color and transparency in the four reservoirs.

Location	Salinity (ppm)	Water depth (cm)	Water color	Transparency (cm)
Bibir Pukur	140±1.73	260.3±13.98	Dark green	20.3±0.23
Amtala Lake	487.3 ±1.45	164.33±7.53	Greyish green	22.85±0.02
Choumatha Lake	241±1.52	179.33±4.33	Blackish green	38.33±0.24
CC Pond	180.66±1.20	125.33±2.60	Green	58.36±0.08

Temperature

The lowest value of temperature (30.56±0.06 °C) was recorded in Amtala Lake and highest value was found in City Corporation Pond which was 31.77±0.09 °C on average. Temperature of those water reservoirs varies probably due to the degree of the water pollution.

Electric conductivity

Bibir Pukur as well as Choumatha Lake have a comparatively low electric conductivity (EC) value, 0.343 ms/cm and 0.353 ms/cm respectively, which is indicative to a better water quality. On the other hand, Amtala Lake showed 0.413 ms/cm and City Corporation Pond showed 0.380 ms/cm, which is comparatively higher electric conductivity (EC) that indicates it is occur due to water pollution.

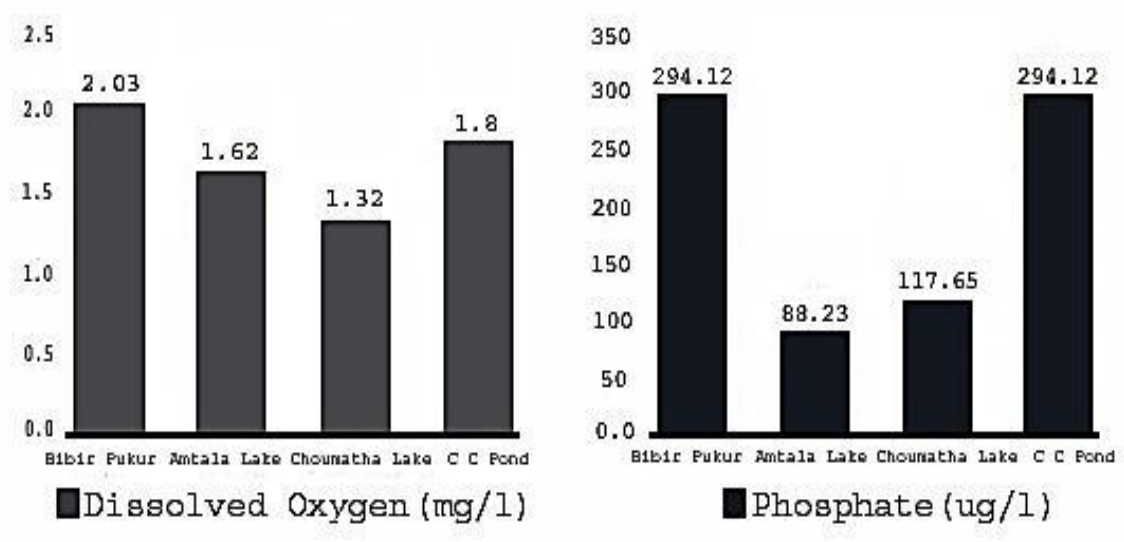

Figure 2. Graphical presentation of dissolved oxygen and phosphate of the studied water reservoirs.

Total dissolved solids (TDS)

The highest value of total dissolved solids was recorded in Amtala Lake followed by City Corporation Pond, Choumatha Lake and Bibir Pukur, 199, 179, 168 and 161 ppm respectively. The highest total dissolved solids (TDS) were determined as 199 ppm in this studied area. Addition of organic substances from decomposed aquatic organisms may responsible for the value of total dissolved solids (Table 1). As variations of TDS values, these reservoirs could have the variations in algal diversity present within these water bodies (12).

Water pH

In the present study, we found that all this four water reservoirs have a mild alkaline water quality (pH>7). This is probably occurring due to application of lime for pisiculture, use of soap and detergent by local people for their bath and washing activities. Usually alkaline water helps to proliferate phytoplankton in enclosed water body has shown that pH range 7-8 is suitable for fish culture as well as most of aquatic organisms (13). In most raw water sources, pH lies within the range of 6.5-8.5 (14-16). The pH of these water reservoirs indicate the possibility of suitable aquaculture, and previously reported that this City has phytoplankton richness in its freshwater bodies (17).

Salinity

Most of the inland water bodies of Barishal district reserve freshwater. Our research revealed a huge variation within this four conserved reservoirs. Among them, Amtala Lake has a much more salinity, 487 ppm, than the rest of the three reservoirs. As variations in salinity can make impacts on phytoplankton growth morphologies, these water reservoirs could have the diversity of aquatic organisms depending on primary producers (18,19).

Water depth

Among the four water reservoirs Bibir Pukur is deepest one (260.33 cm), while City Corporation Pond is shallowest with 125.33 cm depth (Table 2).

Water color

Reid (1961) classified variety of color of water due to presence of organism associated with degraded alternative dissolved organic materials (20). As a one productive and apparent color created by the reflection of sky; the surroundings is indicative of an unproductive water body. From site to site, the color of water was varied of the four water reservoirs. The dominating color of the studied ponds and lakes water were found light green, dark green, greyish green, blackish green, respectively.

Transparency

At this study, transparencies of four totally different site were showed variation from 20.32 cm to 58.42 cm. Transparency of water depend on the suspended and mixture matter. Transparency ranged from fifteen to forty cm is taken into account sensible for fish culture (21,4). Consequently, these results indicated that the four water reservoirs are sensible for fish culture.

Dissolved Oxygen

Our research revealed a variation within this four conserved ponds and lakes. Bibir Pukur with

2.03±0.12 mg/l has much more dissolved oxygen than rest of the three reservoirs. The standard DO value of surface water for Bangladesh is 6 or more (22). Huq and Alam, (2005) mentioned that water with DO value ranging 4-6 mg/l is suitable for drinking purpose (23). According the earlier report, the aquatic ecosystem could be affected by the amount of dissolved oxygen of water. This four studied water reservoirs showed lower DO values comparatively than the country's standard value.

Phosphate

At this study, phosphate of four totally different water sources was varied from 88.23±2.29 to 294.12±3.92 µg/l. Here, the amount of phosphate of two reservoirs, Bibir Pukur and City Corporation Pond, is almost equal with 294.12±3.92 and 294.12±2.19 µg/l value, respectively (Figure 2). These two reservoirs provide maximum values of phosphate comparatively than Amtala Lake and Choumatha Lake, which means the ponds possess higher amount of phosphate.

CONCLUSION

The results obtained from the present study will be useful in future management of the lakes and ponds in this city. However, certain action and arrangement is necessary to maintain the ecosystem of these lakes and ponds, as well as public awareness is also significant to reduce the associated pollution.

CONFLICT OF INTEREST

No conflict of interest.

REFERENCES

1. Patra RWR, Azadi MA. Ecological studies on the planktonic organisms of the Halda River. Bangladesh Journal of Zoology. 1987; 15(2):109-23.
2. Islam AKMN, Rahman M, Chowdhury AR. Hydrological studies of Dhanmondi lake in Dhaka. Journal of Asiatic Society, Bangladesh. 1979;5(1) 59-75.
3. Ahipathi MV, Puttaiah ET. Ecological characteristics of Vrishab havathi River in Bangalore (India). Environmental Geology. 2006;49:1217 -222.
4. Benjamin R, Rakrapani BK, Devashish K, Nagarathna AV, Ramachandra TV. Fish mortality in Bangalore lakes, India. Electronic Green Journal. 1996, 6.
5. Agbaire PO, Obl CG. Seasonal variation of some physico-chemical properties of River Ethiope water in Abraka, Nigeria. Journal of Applied Sciences and Environmental Management. 2009; 55-57.
6. Verma P, Chandawat D, Gupta U, Solanki HA. Water quality analysis of an organically polluted lake by investigating different physical and chemical parameters. International Journal of Research in Chemistry and Environment. 2012;2:105-112.
7. FAO (Food and Agriculture Organization). Physical and chemical methods of soil and water analysis. 1984. vol. 10.
8. Patil PN, Sawant DV, Deshmukh RN. Physico-chemical parameters testing of water: A review. Int J Environ Sci. 2012;3:1194-207.
9. Faith N. Water quality trends in the Eerste River, Western Cape, 1990- 2005. A mini thesis submitted in partial fulfillment of the requirements for the degree of Magister Scientiae, Integrated Water Resources Management in the Faculty of Natural Science, University of the Western Cape. 2006, pp.41.
10. Khan SM, Munzurul H, Aziz KMS, Morshed MG, Shafi M. Seasonal variations in physico-chemical conditions of Dhanmondi lake water. Bangladesh Journal of Zoology. 1990;8(1):61-66.
11. Tuncer GT, Tuncel SG, Tuncel G, Balkas,TI. Metal pollution in the Golden Horn, Turkey: Contribution of natural and anthropogenic ecomponents: ER Christensen, DN Edgington, JP Giesy (Eds.), Water Science and Technology: Contaminated aquatic sediments, Oxford: Elsevier Science, Ltd. 1993, pp.59-65.
12. Dwivedi BK, Pandey GC. Physico-chemical factors and algal diversity of two ponds, (Girija Kund and Maqubara pond), Faizabad. Pollution Research Society. 2002;21:361-70.
13. Jhingran VG. Fish and fisheries of India. Hindustan Pub. Corp., Delhi. 1985.
14. Ahmed MF, Rahman MM. Water supply and sanitation. ITN-Bangladesh, Centre for Water Supply and Waste Management, BUET, Dhaka, Bangladesh. 2000.
15. Khatun I, Das SK, Hossen R. Assessment of germination and feasibility of hydroponic growth of onion by four common water sources from Barishal region, Bangladesh. Fmg & Mngmt. 2019;4(2):82-6.
16. Hossen R, Chakraborty S, Karmaker D, Das SK. Physico-chemical parameters and diversity of phytoplankton in Kirtankhola River, Bangladesh. Current World Environment. 2021;16(1):190-97.
17. Chakraborty S, Karmaker D, Das SK, Hossen R. First report on phytoplankton communities of Barishal City, Bangladesh. Current Botany. 2020;11:142-47.
18. Das NG and Bhuiyan, AL. Limnoplankton of some inland waters of Dhaka city. Bangladesh Journal of Zoology. 1974;2(1):27-42.
19. Chakraborty S, Karmaker D, Rahman M A, Bali S C, Das SK, Hossen R. Impacts of pH and salinity on community composition, growth and cell morphology of three freshwater phytoplankton. Plant Science Today. 2021;8(3):655–61.
20. Reid GK. Ecology of inland waters and estuaries. Reinhold Publishing Corporation, New York. 1961, pp.375.
21. Boyd CE. Water quality management for pond fish culture. Elsevier Sci. Pub l. Co., New York, USA. 1982, pp. 318.

22. ECR (The Environment Conservation Rules). Government of the People's Republic of Bangladesh. Ministry of Environment and Forest. 1997, pp.205-207.

23. Huq SMI and Alam MD. A handbook on analysis of soil, Plant and Water. BACER-DU, University of Dhaka, Bangladesh. 2005, pp.1-246.

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Author's contributions

TS participated in lab work, preparation of manuscript and coordination. MH participated in field and lab work. ARL participated in field and lab work. TI also participated in field and lab work.

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