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# Comparative Study of Physico-Chemical Characteristics of Water of Bhairwa and Shahjangi Pond of Bhagalpur

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***Abstract:*** *Urban ponds nestled within the busting landscapes of cities represent unique and dynamic ecosystem that offer a myriad of ecological, aesthietic and recreational benefits. One key aspect of urban ponds is their ability to support a diverse range of flora and fauna.*
*Despite their positive attributes, an urban pond faces several challenges. Pollution from urban runoff, including chemicals, litter and nutrients can degrade water quality and harm aquatic life. Bhagalpur, an, ancient silk city in the state of Bihar is known for its historical and cultural significance.*
*In Bhagalpur district there are many ponds that have cultural or historical importance serving as landmarks or being associated with local traditions. Shahjangi and Bhairwa pond located in the heart of city is one of them.*
*In present study the physicochemical parameters of these two ponds are assessed and hence the overall quality of these aquatic ecosystem was determined monitoring these parameter helps assess the suitability of ponds for various aquatic life forms and can indicate the potential environmental issues.*

***Key Words:*** *Ponds, Pollution, Physico-chemical Parameters.*

## 1. INTRODUCTION:

Aquatic ecosystem is an important component of global environment. It serves as essential contributor to biodiversity and ecological productivity.

Aquatic ecosystem consists of fresh water ecosystem and marine ecosystem. Fresh water ecosystem are of two types – Lotic and Lentic. The Lotic type ecosystem refers to fast flowing water which moves in one direction. It includes rivers and streams Whereas, Lentic type ecosystem refers to stationary or stagnant water.

Today the water quality of ponds are deteriorating due to number of factors including rapid urbanization, agricultural interference, sewage discharge etc.

From the last few decades fresh water bodies like lakes and ponds are facing the pollution stress due to anthropogenic activities. (Jindal & Vatsal, 2003; Thakur et al., 2022).

Since the human activities like discharge of domestic sewage, garbage's, industrial effluents and other anthropogenic activities are interferring the pond biodiversity.

Keeping the point out, the current work is designed to investigate the physicochemical characteristic of two pond water of Bhagalpur districts Bhairva and ShahJangi Pond.

## 2. MATERIALS AND METHOD:

**Duration of study**

The study was conducted for a period of fifteen months (October, 2021 to December, 2022)

**Time of sampling**

All samples were collected between 8:00 am - 9:30 am.

The following methods were used for the different physico-chemical parameters.

- **Water Depth:-**

Depth is the minimum vertical distance between the surface and the underlying bottom of the pond at any point. Secchi disc was used to determine the water depth. The rope was tied to the central hook of the Secchi disc and lowered in water till the bottom after that length of the rope was measured is expressed the water depth in meter.

- **Temperature:-**

SKADIOO Digital temperature thermometer were used to measure the temperature of the sample water. The thermometer sensor was dipped into the sample and readings were taken. Sufficient time was given for the detection of constant reading. It is expressed in $^{o}C$

- **Transparency:-**

Transparency of water was studied by the help of Secchi transparency disc. Transparency is inversely proportional to the turbidity of water, which in turn is directly proportional to the amount of suspended organic and inorganic matters. When the Secchi-disc is gradually lowered in water it remains visible in the euphotic zone, only to that lower level where light is about 15% of the radiation at the surface.

**Method -** The Secchi disc was dipped in water and the depth (in cm) was noted at which it seems disappeared. After that disc was raised upward and the depth was noted at which it reappears. The average value was taken as Secchi disc depth (Sdd) or Transparency.

- **pH:-**

pH is defined as the negative logarithm of the Hydrogen ion concentration in a solution. It can be measured by various methods like the colorimetric method, Digital pH meter, Electrode pH meter and various indicator or paper strips. In the present study, METRAVI pH-600 Digital pH meter was used to determine the pH of the sample water.

- **Total Dissolved Solids:-**

Total dissolved solids was determined by the digital HM TDS-3 meter. Sample water was taken in a beaker and the sensor side of the TDS meter was dipped into it and the reading was noted.

- **Dissolved Oxygen:-**

BOD bottles (300 ml) were used to collect water samples, and all relevant safety measures were taken. At the actual sampling site, oxygen was fixed using Winkler's A (manganous sulphate) and Winkler's B (alkaline potassium iodide) solutions.

Starch was used as an indicator; the precipitate was dissolved in Sulphuric acid and titrated with 0.025N sodium thiosulphate. For dissolved oxygen estimation, the modified Winkler's method was applied (APHA, 1998).

- **Free $CO_2$:-**

Titrametric analysis of free carbon dioxide was performed using phenolphthalein as an indicator to produce a pink colour, which was then quantified in parts per million (ppm) (APHA, 1998).

- **Total Hardness: -**

The EDTA titrimetric method was used to determine the total hardness of the water samples (APHA, 1998). Results were expressed in terms of ppm and eriochrome black T was employed as an indicator.

- **Total Alkalinity:-**

Combining the two values—carbonate alkalinity measured with phenolphthalein indicator and bicarbonate alkalinity measured with methyl orange indicator—to estimate the total alkalinity of water samples (APHA, 1998). The outcomes were presented as ppm.

- **Chloride:-**

Chloride content was measured by colorimetric method. Chloride was titrated with soluble silver salt in presence of chromate is formed at the end (iodide and bromide, when present get registered as chloride).

- **Biological Oxygen Demand: -**

By modifying Winkler's technique using azide, the biochemical oxygen requirement was calculated. BOD bottle was prepared and incubated at 20°C for 5 days in the dark.

- **Chemical Oxygen Demand: -**

The procedure outlined in standard techniques was used to determine COD. 50 ml of the water sample were taken, and 10 mL of potassium dichromate solution and 1g of mercuric sulphate were thoroughly mixed with the sample in a reflux flask. Antibumping beads were added to the solution to prevent it from boiling over. Then, carefully pouring 10 ml of concentrated sulfuric acid containing silver sulphate into the condenser's open end, it was blended by swirling.

- **Nitrate:-**

The phenol disulphonic acid spectrophotometric technique was used to measure nitrate-nitrogen (APHA, 1998).

- **Phosphate:-**

Orthophosphate was measured using the spectrophotometric methods of ammonium chloride and stannous chloride (APHA, 1998).

## 3. RESULTS AND DISCUSSIONS:

Assessment of various physiochemical parameters ranging from Water depth, Transparency, Temperature, pH, TDS, DO, Free $CO_2$, Hardness Alkalinity, Chloride, BOD, COD, Nitrate and phosphates for the period of 12 months in both ponds showed that values were in optimum range and hence fish culture can be practiced in all the seasons, concentration of nutrients like nitrogen, phosphorous, chlorides and carbonates were indicating the fertility nature of both urban ponds.

| Sl No. | Parameters | January | February | March | April | May | June | July | August | September | October | November | December | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Water Depth | 4.62 | 4.62 | 4.62 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.605 |
| 2 | Transparency | 57 | 59 | 59 | 56 | 53 | 53 | 53 | 53 | 55 | 55 | 55 | 56 | 55.33 |
| 3 | Water Temp | 18.0 | 19.2 | 22.3 | 26.5 | 29.0 | 33.8 | 32.1 | 29.4 | 27.5 | 26.1 | 21.8 | 19.6 | 25.441 |
| 4 | pH | 7.49 | 7.41 | 7.34 | 7.26 | 7.21 | 7.19 | 7.20 | 7.22 | 7.24 | 7.26 | 7.31 | 7.35 | 7.29 |
| 5 | TDS | 76 | 78 | 81 | 84 | 89 | 92 | 93 | 95 | 87 | 84 | 78 | 75 | 84.33 |
| 6 | DO | 6.31 | 6.34 | 6.30 | 6.17 | 6.09 | 5.89 | 5.88 | 5.91 | 5.97 | 6.00 | 6.08 | 6.24 | 6.09 |
| 7 | Free CO2 | 2.43 | 2.41 | 2.40 | 2.49 | 2.51 | 2.54 | 2.57 | 2.61 | 2.68 | 2.31 | 2.33 | 2.39 | 2.47 |
| 8 | Total Hardness | 52.31 | 52.39 | 53.12 | 53.84 | 53.97 | 57.87 | 60.45 | 61.54 | 59.11 | 58.45 | 55.77 | 53.01 | 55.98 |
| 9 | Total Alkalinity | 83.11 | 81.24 | 81.29 | 84.23 | 86.75 | 88.81 | 89.62 | 88.17 | 87.32 | 87.02 | 85.16 | 83.98 | 85.98 |
| 10 | Chloride | 58.21 | 58.39 | 58.67 | 59.45 | 60.25 | 60.69 | 60.97 | 61.42 | 61.38 | 61.09 | 59.21 | 59.07 | 55.48 |
| 11 | BOD | 3.64 | 3.72 | 3.91 | 4.13 | 4.75 | 5.05 | 5.00 | 4.98 | 4.91 | 4.83 | 4.15 | 4.03 | 4.42 |
| 12 | COD | 4.89 | 4.91 | 5.34 | 5.69 | 5.87 | 5.92 | 5.97 | 6.45 | 6.53 | 6.48 | 6.05 | 5.59 | 5.80 |
| 13 | Nitrate | 2.41 | 2.65 | 2.73 | 2.86 | 2.89 | 2.93 | 2.81 | 2.76 | 2.73 | 2.69 | 2.65 | 2.52 | 2.71 |
| 14 | Phosphate | 1.54 | 1.64 | 1.73 | 1.82 | 1.88 | 1.96 | 2.31 | 2.46 | 2.86 | 2.42 | 2.01 | 1.71 | 2.02 |

**Table -1**

Monthly Variation of Physico-Chemical Parameters of Bhairwa Pond (January 2021-December 2022)

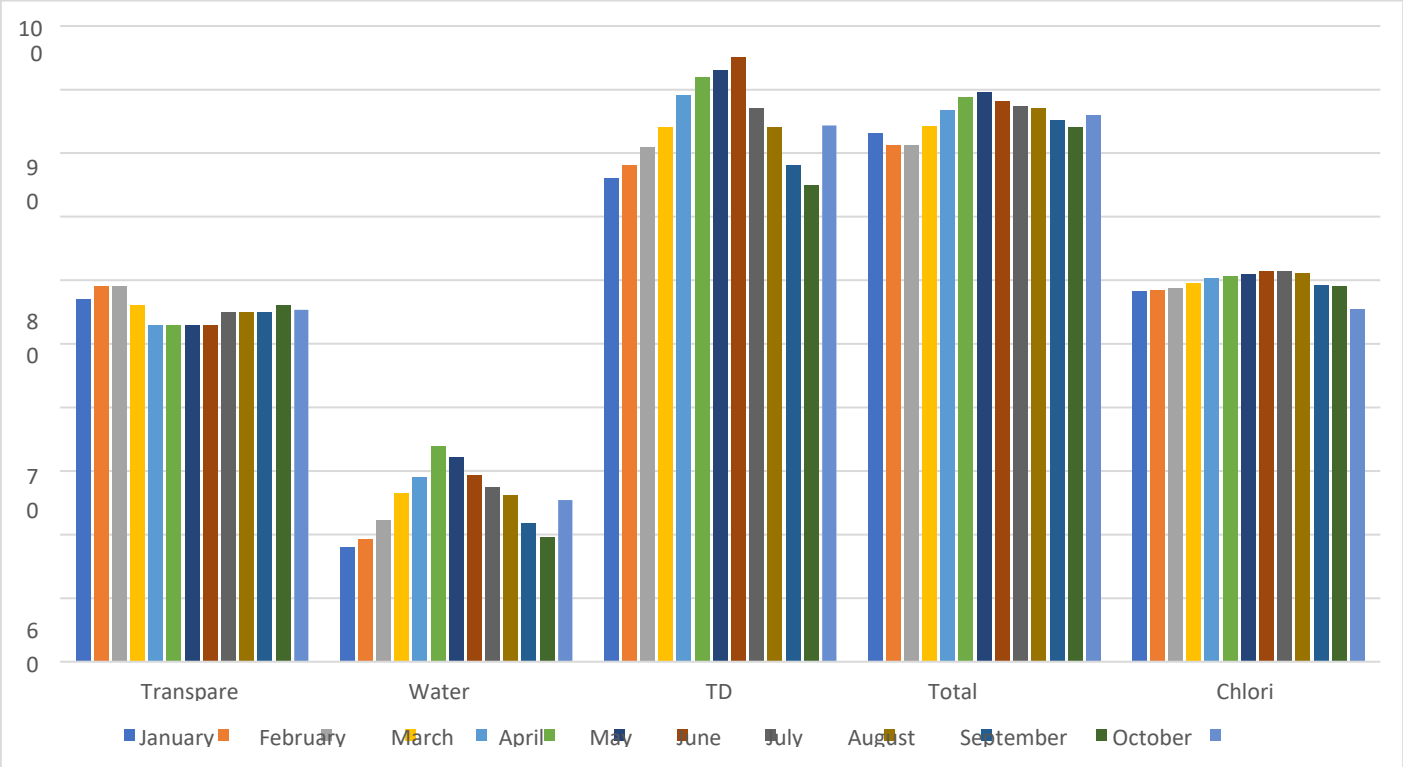


**Fig -1**

Graphical Representation of Monthly Variation of Physico-Chemical Parameters of Bhairwa Pond

( January 2021-December 2022)

| Sl No. | Parameters | January | February | March | April | May | June | July | August | September | October | November | December | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Water Depth | 4.62 | 4.62 | 4.62 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.605 |
| **2** | Transparency | 57 | 59 | 59 | 60 | 60 | 61 | 59 | 59 | 60 | 61 | 59 | 58 | 59.33 |
| **3** | Water Temp | 18.0 | 19.3 | 22.4 | 26.4 | 29.0 | 33.8 | 32.1 | 29.4 | 28.5 | 26.2 | 21.4 | 19.5 | 25.50 |
| **4** | pH | 7.5 | 7.45 | 7.44 | 7.36 | 7.31 | 7.29 | 7.26 | 7.27 | 7.28 | 7.27 | 7.35 | 7.34 | 7.34 |
| **5** | TDS | 77 | 78 | 81 | 85 | 90 | 92 | 91 | 95 | 88 | 84 | 78 | 77 | 84.67 |
| **6** | DO | 6.32 | 6.33 | 6.32 | 6.19 | 6.28 | 6.05 | 5.89 | 5.91 | 5.96 | 6.00 | 6.09 | 6.23 | 6.13 |
| **7** | Free CO2 | 2.42 | 2.40 | 2.41 | 2.59 | 2.61 | 2.44 | 2.77 | 2.81 | 2.78 | 2.61 | 2.53 | 2.49 | 2.57 |
| **8** | Total Hardness | 52.33 | 52.49 | 53.12 | 53.74 | 53.87 | 57.97 | 60.55 | 61.64 | 59.31 | 58.55 | 55.97 | 53.11 | 56.05 |
| **9** | Total Alkalinity | 83.3 | 81.44 | 81.39 | 84.13 | 85.75 | 87.81 | 89.6 | 88.07 | 87.22 | 87.02 | 85.16 | 84.98 | 85.49 |
| **10** | Chloride | 58.21 | 58.34 | 58.64 | 59.55 | 59.25 | 60.89 | 60.37 | 61.22 | 61.28 | 61.29 | 59.11 | 59.7 | 59.82 |
| **11** | BOD | 3.63 | 3.62 | 3.81 | 4.12 | 4.7 | 5.15 | 5.00 | 4.92 | 4.93 | 4.83 | 4.25 | 4.13 | 4.42 |
| **12** | COD | 4.89 | 4.93 | 5.44 | 5.99 | 5.37 | 5.62 | 5.47 | 6.95 | 6.63 | 6.48 | 6.25 | 5.99 | 5.83 |
| **13** | Nitrate | 2.31 | 2.55 | 2.23 | 2.83 | 2.29 | 2.83 | 2.41 | 2.66 | 2.33 | 2.59 | 2.65 | 2.62 | 2.53 |
| **14** | Phosphate | 1.56 | 1.59 | 1.64 | 1.15 | 1.15 | 1.54 | 2.15 | 2.18 | 2.58 | 2.83 | 2.15 | 1.15 | 1.81 |

**Table - 2**

Monthly Variation of Physico-Chemical Parameters of Shahjangi Pond
January 2021-December 2022

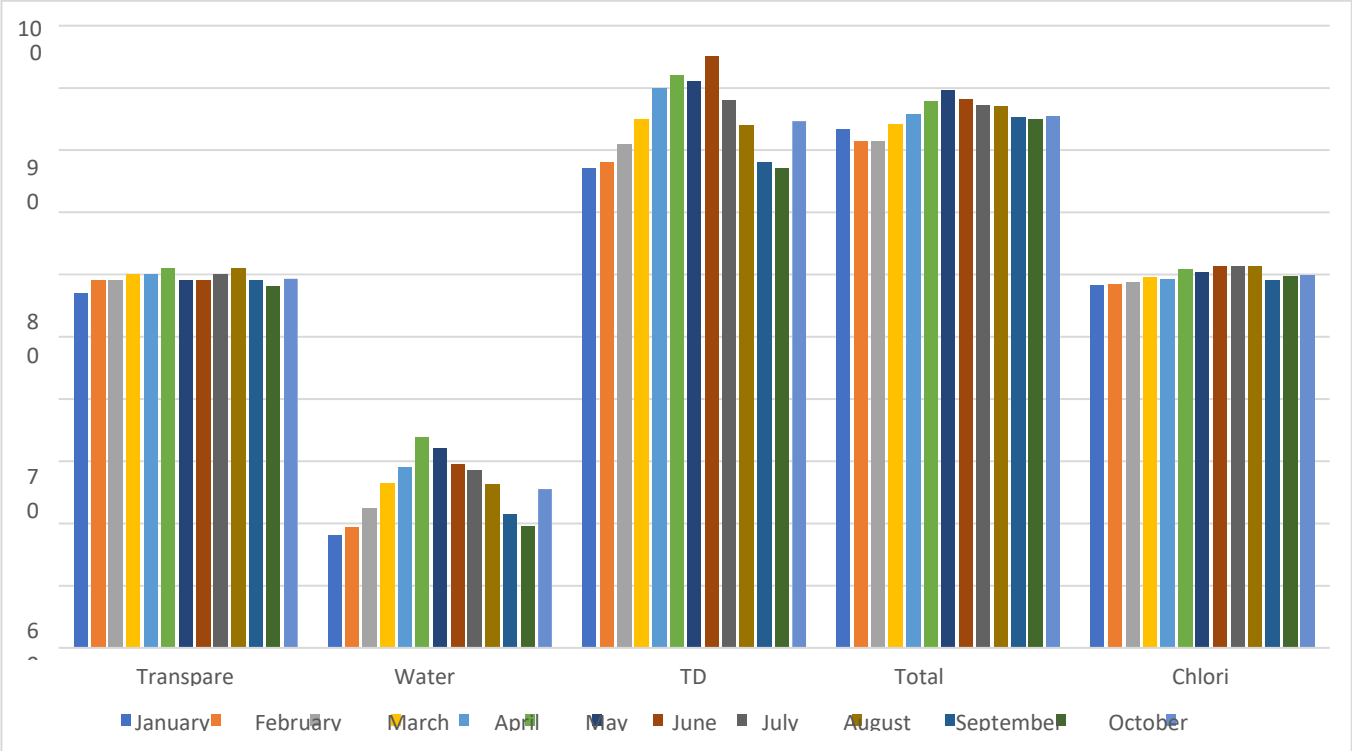


**Fig -2**

Graphical Representation of Monthly Variation of Physico-Chemical Parameters of Shahjangi Pond

January 2021-December 2022

## 4. CONCLUSION:

So, from above discussion it can be concluded that both ponds shows the good productivity and the quality of water is somewhat fit for local residers at some extent.

Through my work, I want to draw attention of local governing bodies to take a strong initiative for the renovation of both ponds, so that it can provide a good employment opportunity for the youth in the field of fisheries or aqua culture. Transformation of these unmanaged ponds through pond management approaches can be proved to be beneficial from financial as well as social point of view.

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