
**E-ISSN:** 2706-8927
**P-ISSN:** 2706-8919
www.allstudyjournal.com
IJAAS 2019; 1(1): 133-137
Received: 19-05-2019
Accepted: 29-06-2019

**Chandni Kumari**
Research Scholar, Department of Zoology, LNMU, Darbhanga, Bihar, India

**Corresponding Author:**
**Chandni Kumari**
Research Scholar, Department of Zoology, LNMU, Darbhanga, Bihar, India

# Comparative study of physico-chemical features of the surface water of pond of Laheriasarai

## Chandni Kumari

**Abstract**
The present work deals with investigation of ecological status including physico-chemical characteristics of these selected ponds. The two ponds (Pond I and II located in Laheriasarai area) have been found to contain polluted water coming from the residential areas surrounding there ponds. Hence ideal step would be to devise a mechanism of treatment/cleaning the domestic sewage before its full in the pond. This can easily be done by the municipal corporation and responsibility should be on the ward councillor of the ward in which these two ponds exist. Till this treatment is not done at least disinfection of the surface water should be done to avoid infection during outdoor bathing by the community which has been witnessed during the study. Water temperature of the pond was found fluctuating due to seasonal fluctuation in ambient temperature. The fluctuation was found due to seasonal variation.
Finally the result of the study indicates that the ponds I and II are fit for pisciculture after some remedial measures like treatment of domestic sewage before its fall in the ponds and restriction of domestic activities in the ponds as far as possible.

**Keywords:** Physico-chemical, surface water, Laheriasarai

## Introductions
Water is the most important resource biosphere and a wonderful chemical which has unique properties of dissolving and carrying in suspension a huge variety of chemical. But the sorry state of affairs is that water resources are being subjected to ecological alternations an account of human activities population growth etc. Thus it can get polluted easily as well.
Ponds are unique sources of lentic freshwater system of fundamental importance to man but are continuously exploited to meet different needs. These are important wetland located in and around human habitations. These are generally semi-natural ecosystem constructed by man in landscape suitable for water stagnation.
The most important physico-chemical characteristics of water are temperature, conductivity, pH, secchi transparency, total hardness, total alkalinity, free $CO_2$, dissolve oxygen, chloride, phosphate, total suspended solids and volatile solids etc. The most important investigation carried out in the field of limnology are those of Secchi (1856), Hutchinson (1957), Chakraborty et al., (1959), Verma (1979), Rao (1955), Wetzel (1966), Adoni (1975), Datta et al., (1985), APHA (1989), Dixit et al., (1988), Gaur et al., (1989), Shukla and Bais (1990), Verma (2004), Kumar (2012), Kumar and Verma (2012) [23], Kumar (2013). Noor and Alam (2001) considered the great variability in Physico-chemical nature of water and proposed a scheme of classification based on the ratio of nitrogen, phosphorus and human content of water.
The physico-chemical properties of water are influenced by a large number of factors. A number of Indian workers have contributed signification in this area includes Ganpati (1940, 1941, 1943, 1959), George (1961), Sreenivasan (1964, 1965, 1969), Zafar (1964, 1967), Hussainy (1965) Michel (1975, 1977, 1978, 1980), Jana and Das (1980); Kaul (1983), Agrawal (1987); Bhowmik (1988); Changiowal and Chatterjee (1987); Khilare (1987); Pandey (1987); Singhal (1980); Tiwari (1999); Chatterjee (2000).
The trophic level of the lakes, ponds, swamp indicates it productive potential. Several workers have worked out certain indices related to productive potentials of a system. Bathymetric factors physico-chemical conditions and different biological characters of a water body have long been used as the indices of its trophic status.

## Material and Method
**Study Area:** The two ponds selected for the present study are known as said Nagar Pond (Pond I), Rai Saheb Pond (Pond II) are located in Laheriasarai.

**Study of Water Sample**

**Sampling and sample processing:** Observation and analysis were done every month, however the results are expressed on seasonal basis as the variations in months of a particular seasons were of less magnitude. Since the climate of the season is tropical monsoonic three seasons have been categorized viz rainy (July-October), winter (November-February) and summer (March-June). The sampling was done during forenoon (9-11 AM) and the water samples were collected from the surface and the river bed of the water body as the depths were quite variable. The samples were taken into one liter plastic bottles for estimation of the physico-chemical parameters.

**Physico-Chemical Analysis of Water**

**Temperature:** Surface water temperature was recorded with the help of mercury thermometer while bottom water temperature was recorded by a reversible thermometer.

**Hydrogen ion concentration (pH):** The pH of water was recorded with the help of Griph meter (electronic), Hanna Japan.

**Electrical conductivity:** It was recorded with the help of conductivity meter and the value was expressed as Micro Siemens/cm.

**Dissolved oxygen ($DO_2$):** It was analyzed by the Winkler's method (volumetric) with azide modification. The sample was collection in BOD bottle without bubbling and was fixed with 2ml of $MnSO_4$ followed by 2ml of alkaline iodine. The resultant brown precipitate was dissolved by the addition of 2ml of conc. $H_2SO_4$.50ml of the above solution was titrated against N/40 $Na_2S_2O_3$ Using starch as an indicator.

The $DO_2$ is calculated by the following formula:-

$$DO_2\,(mg/l) = \frac{8 \times 1000 \times N \times V_i}{V_2}$$

Where, $V_1$ = Volume of the titrant
$V_2$ = Volume of the sample titrated
N = Normality of $Na_2S_20_3$

**Free Carbon Dioxide ($FCO_2$):** It was estimated with the help of phenolphthalein as indicator and titrated against standard alkali (N/44NaOH) solution. To 50ml of sample water, 2 drops of above indicator was added solution remains colorless which indicates the presence of $FCO_2$ in the sample. Now. It was titrated against N/44 NaOH. End point was slight pink in color.

Calculation was made as follows:-

$$FCO_2(mg/l) = \frac{ml\ \ of\ \ titrated\ \ \times 1000}{ml\ \ of\ \ sample\ \ \ water}$$

**Total Hardness:** It was determined by titrimetric method using EDTA as titrant and Erichrome Black 'T' as an indicator (APHA, 1989).

To 50ml of sample water half tablet of Erichrome Black 'T' indicator was added and shaken well. To it 1.0ml of Ammonia buffer was added followed by 0.5ml of 4N NaOH. The color of the sample developed to wine red. This solution was titrated against N/50 EDTA solution. End point was blue color. Calculation was made as follows:-

$$\text{Total Hardness (mg/l)} = \frac{ml\ \ of\ \ titrated\ \ \times 1000}{ml\ \ of\ \ sample\ \ \ water}$$

**Chloride (CI):-** It was estimated by argentotitrimetric method APHA (1989), Using 0.014N $AgNo_3$ as titrant and potassium chromate as an indicator.

Calculation was made as follow:-

$$Cl^{-}(mg/l) = \frac{ml\ \ of\ \ titrant\ \ \times N \times 35.46 \times 1000}{ml\ \ of\ \ sample\ \ \ water}$$

**Phosphat ($PO_4^{3-}$):** It was determine spectrophotometrically. 50ml of sample water was filtered (whatman Filter Paper). 2ml of ammonium molybdate reagent was added followed by 5dropes of $SnCl_2$ solution. Blue color development. The absorbance of this blue color was read at 690mm on a Spectrophotometer (systronics) using distilled water as a blank. The value was compared with the Standard Curve and expressed as mg/l.

**Secchi Transparency:** Transparency of water was measured by a standard Secchi disc of 20cm diameter attached to a marked Plastic tape.

**Total Alkalinity:** Total alkalinity of water was obtained by adding phenolphthalein and methyl orange alkalinities i.e Total Alkalinity (T.A) = P.A+M.A.

Total Alkalinity = Phenolphthalein Alkalinity (P.A.) + Methyl Orange Alkalinity (M.A.)

**Result and Discussion**

Water is the life Supporting Universal Solvent on earth around which the entire fabric of life is woven. But the sorry state of affairs is that water resources are being subjected to ecological alternation on account of human activities, population growth etc. The component of pollution contributes to greater Oxygen demand and nutrients loading of the water bodies promoting toxic algal blooms leading to destabilized aquatic ecosystem (Morrison et al., 2001). Ponds are unique sources of lentic fresh water system of fundamental importance to man but are continuously exploited to meet different needs.

Nutrient cycle vis-a-vis chemical properties of water gap has been studied by several authors. Rigler (1964), Stumm and Morgan (1970), Ponnamperuma (1972) and Donk et.al., (1993) have studied transformation of phosphate in an aquatic body. Similarly, transformation and cycling of nitrogen in an aquatic body have been intensively studied by Gambrell and Patric (1978), Mohanty and Das (1982) and Brush and Nilson (1993). The biogeochemical cycle of nutrient has also been described by Odum (1971)] Cole (1979) and Das (1989).

As depicted in (Table 1-6) the parameter studied for physico-chemical analysis of water included temperature, $p^H$, Secchi-transparency, Conductivity, dissolved Oxygen, free carbon dioxide, total alkalinity, Chloride, total hardness and phosphates.

**Table 1:** Physico-chemical analysis of the surface water of Said Nagar Pond, Laheriasarai (Pond I) during July 2017 to June 2018

| Month | Water Temperature (cc) | pH | Secchi Transparency (cm) | Conductivity (µmho/cm) |
|---|---|---|---|---|
| July | 31.35 | 6.3 | 34.7 | 557.5 |
| August | 30.8 | 6.4 | 33.6 | 536.7 |
| September | 26.3 | 6.9 | 33.2 | 518.4 |
| October | 24.9 | 7.2 | 34.8 | 501.2 |
| November | 22.75 | 7.4 | 35.3 | 478.3 |
| December | 19.4 | 7.7 | 37.8 | 457.3 |
| January | 18.25 | 7.9 | 38.6 | 430.5 |
| February | 21.35 | 7.5 | 36.8 | 438.4 |
| March | 24.4 | 8.4 | 31.4 | 598.5 |
| April | 26.6 | 8.6 | 30.2 | 648.6 |
| May | 28.7 | 9.5 | 29.5 | 685.8 |
| June | 31.6 | 10.2 | 28.8 | 716.5 |

**Table 2:** Physico-chemical characteristics of the surface water of Said Nagar Pond, Laheriasarai (Pond I) during July 2017 to June 2018

| Month | Total solides(mg/l) | Total Alkalinity (mg/l) | Total Hardness (mg/l) |
|---|---|---|---|
| July | 384.46 | 142.75 | 76.8 |
| August | 398.35 | 154.34 | 77.2 |
| September | 356.25 | 137.72 | 79.8 |
| October | 336.8 | 121.45 | 82.5 |
| November | 274.7 | 86.54 | 94.8 |
| December | 251.5 | 75.23 | 89.4 |
| January | 237.4 | 62.58 | 106.5 |
| February | 301.3 | 69.44 | 112.6 |
| March | 393.85 | 94.87 | 122.4 |
| April | 401.37 | 106.48 | 128.6 |
| May | 426.85 | 113.43 | 134.3 |
| June | 448.75 | 129.54 | 142.7 |

**Table 3:** Physico-chemical feature of the surface water of Said Nagar Pond, Laheriasarai (Pond I) during July 2017 to June 2018

| Month | Dissolved Oxygen (mg/l) | BOD (mg/l) | Free $CO_2$ (mg/l) | Chloride (mg/l) | Phosphate (mg/L) |
|---|---|---|---|---|---|
| July | 6.6 | 3.95 | 6.5 | 86.7 | 0.78 |
| August | 6.4 | 4.23 | 6.4 | 78.9 | 0.69 |
| September | 6.2 | 3.87 | 5.8 | 69.5 | 0.63 |
| October | 6.7 | 3.29 | 2.6 | 59.3 | 0.59 |
| November | 6.9 | 2.86 | 0.7 | 46.4 | 0.48 |
| December | 7.5 | 2.57 | 0.5 | 43.7 | 0.42 |
| January | 7.6 | 2.34 | 0.2 | 39.8 | 0.21 |
| February | 7.2 | 2.6 | 0.3 | 33.7 | 0.07 |
| March | 5.7 | 3.5 | 0.7 | 48.8 | 0.83 |
| April | 5.5 | 3.7 | 0.6 | 52.7 | 0.87 |
| May | 5.3 | 3.85 | 0.9 | 53.8 | 0.93 |
| June | 5.2 | 3.96 | 1.5 | 58.8 | 0.98 |

**Table 4:** Physico-chemical analysis of the surface water of Rai Saheb Pond, Laheriasarai (Pond II) during July 2017 to June 2018

| Month | Water Temperature (0ᶜ) | pH | Secchi Transparency (cm) | Conductivity (µmho/cm) |
|---|---|---|---|---|
| July | 31 | 6.35 | 36.2 | 556.2 |
| August | 30.5 | 6.3 | 38.5 | 592.4 |
| September | 25.8 | 6.75 | 35.5 | 600.4 |
| October | 24.6 | 7 | 38.7 | 498.6 |
| November | 22.5 | 7.25 | 42.6 | 476.6 |
| December | 19.1 | 7.6 | 42.7 | 440.2 |
| January | 18 | 7.7 | 45.6 | 430.4 |
| February | 20.8 | 7.6 | 43.3 | 438.6 |
| March | 23.5 | 8.2 | 33.4 | 592.2 |
| April | 25.9 | 8.4 | 30.5 | 630.6 |
| May | 28.5 | 9.2 | 30.8 | 660.4 |
| June | 30.7 | 10 | 31.7 | 705.4 |

**Table 5:** Physico-chemical characteristics of the surface water of Rai Saheb Pond, Laheriasarai (Pond II) during July 2017 to June 2018

| Month | Total solids (mg/l) | Total Alkalinity (mg/l) | Total Hardness (mg/l) |
|---|---|---|---|
| July | 385.5 | 141 | 76.6 |
| August | 395.5 | 152.25 | 77.4 |
| September | 352.8 | 137.75 | 78.5 |

| | | | |
|---|---|---|---|
| October | 338.5 | 121.5 | 80.6 |
| November | 280.5 | 85.5 | 90.8 |
| December | 248.5 | 74.5 | 89.8 |
| January | 225.5 | 63.75 | 104.6 |
| February | 262.6 | 68.5 | 110.6 |
| March | 398.4 | 93.75 | 120.6 |
| April | 400.6 | 104.7 | 125.6 |
| May | 438.6 | 112.8 | 132.5 |
| June | 450.4 | 125.6 | 140.5 |

**Table 6:** Physico-chemical feature of the surface water of Rai Saheb Pond, Laheriasarai (Pond II) during July 2017 to June 2018

| Month | Dissolved Oxygen (mg/l) | BOD (mg/l) | Free $CO_2$ (mg/l) | Chloride (mg/l) | Phosphate (mg/L) |
|---|---|---|---|---|---|
| July | 6.5 | 3.92 | 6.4 | 82.4 | 0.76 |
| August | 6.6 | 4.25 | 6.2 | 76.6 | 0.69 |
| September | 6.5 | 3.85 | 5.7 | 67.5 | 0.62 |
| October | 6.7 | 3.45 | 2.0 | 58.7 | 0.58 |
| November | 7.1 | 2.85 | 0.6 | 46.4 | 0.45 |
| December | 7.5 | 2.55 | 0.5 | 43.2 | 0.42 |
| January | 7.8 | 2.3 | 0.1 | 38.8 | 0.16 |
| February | 7.4 | 2.5 | 0.25 | 32.6 | 0.07 |
| March | 5.8 | 3.6 | 0.5 | 48.5 | 0.82 |
| April | 5.5 | 3.7 | 0.5 | 52.5 | 0.85 |
| May | 5.4 | 3.8 | 0.8 | 53.5 | 0.92 |
| June | 5.6 | 3.9 | 1.4 | 57.6 | 0.96 |

## Conclusion

As these ponds have been found as biologically closed system hence exchange of nutrients with the surrounding system is not feasible thus lacking natural way of water cleaning and enrichment. Water temperature of the ponds was found fluctuating due to seasonal fluctuation in ambient temperature. Lower transparency was observed during summer due to high planktonic population. Maximum transparency was observed in winter months due to sedimentation of suspended solids. Minimum conductivity was found in the water of pond I due to utilization of ions by the living community. This conductivity was found to have signification positive correlation with the free $CO_2$, total alkalinity and phosphate whereas negative correlation with pH, dissolved $O_2$. Higher values observed during post monsoon period can be attributed to increased nutrient status of water leading to its eutrophication.

Finally, the result of the study indicates that the pond I and II are fit for pisciculture after some remedial measures like treatment of domestic sewage before its fall in the ponds and restriction of domestic activity in the pond as far as possible.

## References


1. Adoni AD, Joshi G, Ghose K, Chaurasia SK, Vaishya AK, Yadav M, *et al*. Work Book on limnology. Pratibha publisher C-10, Gour Nagar, Sagar-470003. India, 1985.
2. APHA. Standard Methods for the examination of water and waste water. American public Health Association. Washington. D.C.P 1000, 1998.
3. Chaurasia M, Pandey GC. Study of physico-chemical characteristic of some water pond of Ayodhya-Faizabad. Indian J Environmental Protection 2007;27:1019-1023.
4. Chaurasia SK, Adoni AD. Zooplankton dynamics in a shallow eutrophic lake.proc. Nat. symp. Pure Appl. Limnology Bot. SOC. Sagar 1985;32:30-39.
5. Dhamija SK, Jain Y. Variation in thephysico-chemical characteristics of a lentic water body of Jabal (M.P.) Journal of Environment and pollution 1994;1:125-128.
6. Goel PN, Khatavkar AY, Kulkarni AY, Trivedi RK. Limnological studies of a few freshwater bodies in southwestern Maharashtra with special reference to their chemistry and pollution. Poll. Res 1986;5M:79-84.
7. Hulyal SB, Kaliwal BB. Seasonal variations in physico-chemical characteristics of Almatti Reservoir of Bijapur district, Karnataka. IJEP 2011;1:58-67.
8. ISI. Tolerance limits for inland surface water when used as raw water. General limits. Is: 2296, 1974.
9. Jhingram VG. Fish and fisheries of India. 2nd Edn. Hindustan Publishing Corporation. India, 1982.
10. Joshi PC, Singh A. Analysis of certain physico-chemical parameters and plankton of freshwater hill stream at Nanda Devi Biosphere reserve. Uttar Pradesh J Zool 2001;21:177-179.
11. Jain CK, Bhatica KKS, Vijay T. Ground water quality in coastal region of Andrapradesh. Indian J Envir. Health 1997;39:182-190.
12. Kaushik S, Saksena DN. Physico-chemical limnology of certain water bodies of central India. In freshwater Ecosystem in India. (Kvismayan), Daya publishing House, New Delhi, 1999, 336.
13. Keremah RI, Davides OA, Abezi ID. Physico-chemical Analysis of fish pond water in freshwater areas of Bayesia state, Nigeria. Greener Journal of Biological Sciences 2014;4:33-38.
14. Kiran BR. Physico-chemical characterstics of fish ponds of Bhadra project at Karnataka. RJCABP 2010;3:671-676.
15. Morrson GO, Fatoki OS, Ekberg A. Assessment of the impact of point sources pollution from the kesikauma river water S.A. 2001;27:475-450.
16. Munwar M. Limnological studies on freshwater ponds of Hyderabad. India. I. The biotype. Hydrobiol. 1970;35:127-162.

17. Nandan SN, Patel RJ. Ecological studies of algae in aquatic ecology. Ashish publishing House, New Delhi, 1992.
18. Padma S, Periakali. Physico-chemical and geochemical studies in pulicat lake, east coast of India. Indian J. Mar. sci. 1999;28:434-437.
19. Ramulu NK, Benerjee G. Physico-chemical factors influenced plankton biodiversity and fish abundance. A case study of Andhra Pradesh. Int. J Life sc. Bt. and pharm. Res, 2013.
20. Roy SP. Limno-biology of freshwater resources of Santhal pargana (Jharkhand) India. Proc. Zool. Soc. India 2006;5:101-119.
21. Shah JA, Pandit AK. Physico-chemical characteristics of water in Wular Lake- A Ramsar site in Kashmir Himalaya. International Journal of Geology, Earth and Environmental sciences. 2012;2:257-267.
22. Singh RP, Mathur P. Investigation of Variations in physico-chemical characteristics of a freshwater reservoir of Ajmercity, Rajasthan. Ind. J Environ. Sciences 2005;9:57-61.
23. Verma PK, Purohit AR, Patel NJ. Pollution status of Chandlodia Lake located in Ahmedabad, Gujarat. IJERA 2012;2:1600-1606.
24. Wedia DN. Geology of India Mcmillana and co. New Delhi, 1961.
25. Welch PS. Limnology. Mc Graw Hill Book company New York, Toronto and London, 1952.
26. Wetzel RG. Limnology W.Bsaunders company pub. Philadelphia, London, Toronko 1975, 740.
27. Yadav P, Yadav VK, Yadav AK, Khare PK. physico-chemical characteristics of a freshwater pond of Oria, U.P. Central India. Octa Journal of Biosciences 2013;1:177-184.
28. Fokmare AK, Musaddiq M. Comparative studies of physico-chemical and bacteriological quality of surface and ground water at Akole (MS). Pollution Research 2001;4:56-61.