



ISSN : 0973-7057

Analysis of physico-chemical parameters of Ambhobasabadi Chour situated in Puraini Block of Madhepura, Bihar

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Received : 27th May, 2023 ; Revised : 30th June, 2023

DOI:-<https://doi.org/10.5281/zenodo.13346253>

Abstract- In the present study, physico-chemical parameters of Ambhobasabadi chour was studied during Jan-2020 to Dec-2020. The chour is situated in Puraini block of Madhepura district. The studied parameters were temperature, pH, transparency, E.C. TDS, DO, BOD, COD, Alkalinity, Nitrate, Phosphate and Chloride. The temperature of chour water ranged between 16.8°C to 33.4°C. pH ranged between 6.8 to 8.1. Transparency was maximum in May (72cm) and E.C. was also maximum in May (191.6). TDS ranged in between 162.4 to 265.8. Maximum value of TDS was in the month of May. Maximum alkalinity was observed in May (155.4mg/l) and minimum in the month of December (120.4mg/l). DO ranged in between 5.4mg/l to 9.6mg/l and BOD ranged in between 3.2mg/l to 5.1mg/l. The value of COD was maximum in the month of February (6.6). Nitrate ranged in between 0.91mg/l to 1.30mg/l and phosphate ranged in between 1.48mg/l to 1.95mg/l. Chloride was maximum in the month of May (48.8mg/l) and minimum in the month of October (38.5mg/l).

Key words: Ambhobasabadi chour, pH, DO, BOD, COD

INTRODUCTION

Water is one of the most important components of earth required by all living organisms for their survival. Physico-chemical parameters of water represent its quality. In river, ponds and lakes physico-chemical parameters directly affect aquatic flora and fauna. Industrialization increased human population, use of agrochemicals in agriculture and other human activity are causing heavy and varied pollution in water. Due to adverse change in physicochemical parameters of water in rivers, ponds, lakes and chours (water reservoirs developed in low lands from rain water or river water) adversely affecting aquatic flora and fauna. According to an estimate about 70% of all available water is being polluted due to discharge of

industrial effluent, municipal waste, domestic waster and agrochemicals.¹ In village area agrochemicals like insecticides, pesticides and fungicides, domestic waste, detergents, animal waste are the main source of ponds and chour water pollution. The aim of present study is to estimate physico-chemical characters of Ambhobasabadi chour which is used for fish culture.

MATERIAL & METHOD

In the present study, a chour Ambhobasabadi situated in Puraini block of Madhepura district was selected for analysis of physico-chemical parameter.

Water samples were collected at regular intervals from the selected chours from Jan-2020 to Dec-2020 and examined for temperature, transparency, pH, total solid, E.C., alkalinity, DO, BOD, COD, Nitrate, Phosphate and Chloride.

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Physical parameters of water:

Physical parameters like temperature, pH and transparency were measured at the spot. Temperature was measured by centigrade thermometer, pH was measured using BDH universal indicator and transparency was measured by Secchi disk using following formula:

$$Transparency = \frac{a + b}{2}$$

Where,

a= Depth of water at which Secchi disk becomes invisible.

b= Depth of water at which Secchi disk is visible.

Total dissolved solids (TDS):

For the measurement of Total dissolved solids, a crucible was weighed up to dryness (A) 100ml. Sample water was added in it and weighed again (B). Water was evaporated and the crucible was weighed (C). Total Solid was calculated by the formula:

$$Total\ Solid\ (per\ 100ml) = B - C$$

Electrical conductivity:

For the measurement of Electrical conductivity, 10ml water was taken in a beaker and stirred vigorously. The E.C was measured using Cystronic conductivity meter.

Chemical parameters of water:

Alkalinity:

Alkalinity was estimated by the titrimic method. Water sample was titrated against 0.002N Sulphuric acid using two indicators- Phynolphthaline and methyl orange. 0.2N Sulphuric acid was taken in Burette and 100ml water sample was taken in a conical flask. Few drops of Phenolphthaline were added in water sample and titrated against 0.02N sulphuric acid. Disappearance of pink color was taken as end point. Total volume of 0.02N sulphuric acid was recorded (V₁). Again, 100ml water sample was titrated 0.02N sulphuric acid used was recorded (V₂). Total alkalinity as mg/L CaCO₃ was calculated by the formula:

$$Alkalinity\ \left(\frac{mg}{l}\right) = \frac{(V_1 + V_2) \times N \times 50 \times 1000}{vol.\ of\ water\ sample}$$

Where,

V₁=Vol. of sulphuric acid used for Phenolphthaline alkalinity

V₂=Vol. of H₂SO₄ used for Methyl orange alkalinity

N= Normality of sulphuric acid.

Dissolved oxygen (DO):

The sample was fixed with MnSO₄ and alkali azide iodide. The precipitate was dissolved in Conc. sulphuric acid and titrated with sodium thiosulphate using starch as indicator.

Calculation will done as per the following formula:

$$DO\ mg\ l^{-1} = \frac{N \times V \times 8 \times 100}{ml\ sample\ used}$$

Where,

N = Normality of Na₂S₂O₃

V = Volume of titrant used

Biochemical oxygen demand (BOD):

It is an estimate of the amount of oxygen required to stabilize biodegradable organic material in water bodies by acclimatized microbes. Since long this parameter has proved relevance for water pollution assessment programs. The sample will be incubated in 300 ml. BOD bottles at 20°C for 5 days in dark and the final DO will be measured. Dilution technique will be used frequently. The dilution of water will be prepared by adding 1 ml. each of phosphate buffer, magnesium sulphate, calcium chloride and ferric chloride solution in well aerated distilled water.

The calculation will be done by the following formula:

$$BOD\ 5\ days = DO_i - DO_f \times \frac{300}{sample\ / \ bottle}$$

Where,

DO_i= Dissolved Oxygen of the diluted sample after 15 min.

DO_f= Dissolved Oxygen of the diluted sample after 5 days.

ml. sample/bottle is equivalent to the dilution factor used.

Chemical oxygen demand (COD):

The COD determines the amount of Oxygen required for chemical oxidation of organic matter using a strong chemical oxidant. For the estimation of COD, di-chromate reflex method will be used. Sample was treated with potassium di-chromate and conc. Sulphuric acid. Silver sulphate was used as catalyst. Few drops of ferroid indicator and titrated against standardized 0.10M FAS. COD was calculated by the formula:

$$COD(mgO_2/l) = [(A - B) \times M \times 8000] / V_{sample}$$

Where,

- A= Volume of FAS used for blank (mL)
- B= Volume of FAS used for sample (mL)
- M= Molarity of FAS
- 8000= milli equivalent weight of oxygen (8)
- X1000ml/l

Nitrate:

Nitrate was estimated by the phenol disulphonic acid method. 25 ml. of sample gently evaporated to dryness over a heater. The residue was dissolved in 2 ml. of phenol disulphonic acid and diluted with distilled water. The solution was cooled down on room temperature and slowly and carefully 6 - 7 ml. of ammonia solution was added. The entire solution was transferred to a 100 ml. volumetric flask and the final volume of solution was made to 100 ml. The intensity of the yellow color by the reaction between nitrate and phenol disulphonic acid was measured by recording the absorbance of solution at 420 nm against a reference blank prepared by mixing similar amounts of various reagents. Standard curve for nitrate was prepared by using the above procedure with different known nitrate concentrations.

Phosphate:

Stannous chloride method was used for the estimation of phosphate. This method was quite reliable below an ortho-phosphate level of 0.1 mg/l. To 50 ml. sample 4 ml. ammonium molybdate reagent (25g. (NH₄)₆ MoO₇·4H₂O in 175 ml ddw + 280 ml. conc. H₂SO₄ + 545 ml. ddw) + 0.5 ml. stannous chloride reagent (2.5 gm. SnCl₂·2H₂O 100ml. glycerol) are added with thorough mixing. Exactly between 10-12 minutes all additions, the absorbance of solution was measured at 690 n.m. against a reference blank prepared with distilled water. The standard curve prepared by taking various concentrations of orthophosphate was consulted for finding out the orthophosphate concentrations from the absorbance values. Temperature markedly effects phosphate determination by this method as every 1°C rise in temperature increases the color intensity to 1%. Therefore, all determinations are carried out with temperature fluctuations.

Chloride:

It was measured by the argentometric method. The sample was titrated against 0.014 N silver nitrate (AgNO₃) using potassium dichromate (K₂Cr₂O₇) as an indicator of end point. The chloride was always expressed in the form of sodium chloride.

The value was calculated using following formula:

$$mg\ l^{-1} Cl^{-} = \frac{(A - B) \times N \times 35,450}{ml\ sample\ used}$$

Where,

- A = Amount of AgNO₃ used for sample
 - B = Amount of AgNO₃ used for blank
 - N = Normality of blank
- mg/l⁻¹ NaCl = mg/l⁻¹ Cl⁻ x 1.65

RESULT

Physical parameter:

Among physical parameter, temperature, pH, transparency, TDS and E.C. were examined from Jan-2020 to Dec-2020. Temperature was maximum in the month of June and minimum in the month of January which ranged in between 16.8°C to 33.4°C. pH value was maximum in the month of June and minimum in the month of January ranging in between 6.8 to 8.1. Highest transparency was recorded in the month of May and lowest in the month of August. The value of TDS was maximum in the month of May and minimum in the month of January ranging in between 162.4 to 265.8. Electrical conductivity was maximum (191.6µmhos/cm) in the month of May and minimum (166.2µmhos/cm) in the month of September. The value of temperature, pH, transparency, E.C. and TDS are shown in Fig. 01 to 05.

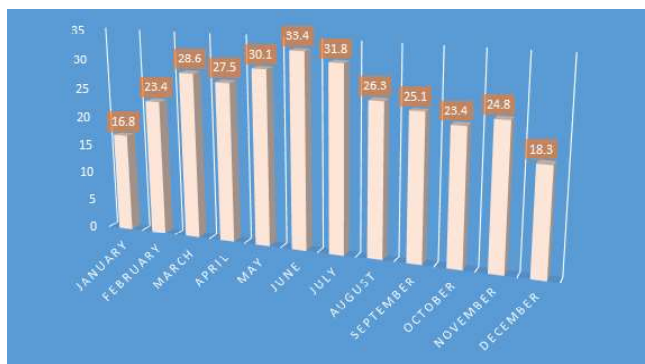


Fig. 01: Average monthly temperature value of Chour water

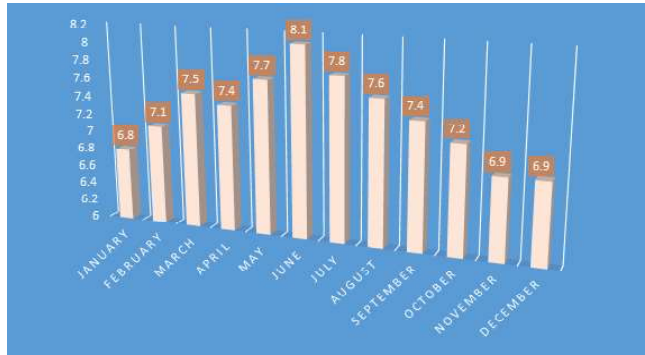


Fig. 02: Average monthly pH value of Chour water



Fig. 03: Average monthly Transparency value of Chour water



Fig. 04: Average monthly E.C. value of Chour water

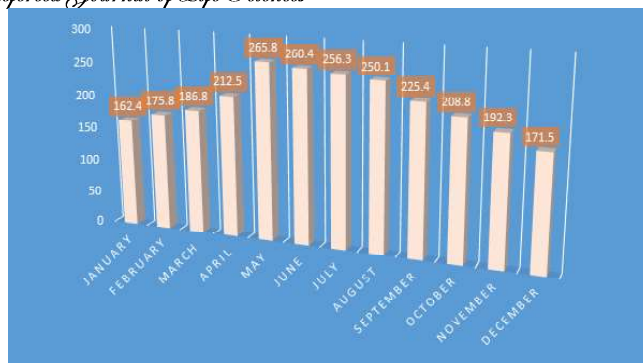


Fig. 05: Average monthly TDS value of Chour water

Among chemical parameters, Alkalinity, DO, BOD, COD, Nitrate, Phosphate and Chloride were determined from Jan-2020 to Dec-2020. Alkalinity was maximum in the month of May and minimum in the December ranged in between 120.4 to 155.4. DO measured was minimum in the month of May and maximum in the month of January which ranged in between 5.4 and 9.6. BOD was minimum (3.2) in the month of July and maximum (5.1) in the month of September. COD was minimum in the month of May (4.9) and maximum in the month of February (6.6). Nitrate ranged in between 0.91 and 1.30. It showed maximum value in the month of October while minimum in the January. Phosphate was minimum in the month of November (1.48) and maximum in the month of June (1.95). Chloride was minimum in the month of October (38.5) and maximum in the month of May (48.8).

The value of all above mentioned chemical parameters are mentioned in Table 01.

Table 01: Average monthly chemical parameters of Chour water

Parameter	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Alkalinity	131.2	131.1	139.6	142.4	155.4	146.3	137.9	131.8	127.3	131.2	125.6	120.4
DO	9.6	9.1	7.4	6.9	5.4	6.3	7.1	7.9	8.3	8.4	9.1	9.3
BOD	4.3	4.2	4.1	3.7	4.3	3.3	3.2	4.8	5.1	4.7	4.2	4.4
COD	6.5	6.6	5.2	5.9	4.9	5.3	5.7	5.3	5.4	5.7	6.2	6.4
Nitrate	0.91	0.93	0.91	0.95	0.99	0.94	0.93	1.26	1.25	1.30	1.23	1.16
Phosphate	1.82	1.84	1.70	1.69	1.88	1.95	1.92	1.85	1.78	1.66	1.48	1.81
Chloride	46.3	45.8	44.1	42.3	48.8	48.1	43.7	41.1	41.2	38.5	42.6	43.2

DISCUSSION

In the present study, five physical parameters namely temperature, pH, transparency, E.C. and TDS were estimated from Jan-2020 to Dec-2020 in the selected Chour. The value of these parameters is mentioned in between Fig. 01 to 05. pH is the hydrogen ion activity in the solution. pH value less than 7 represents acidic medium

while above 7 represents alkaline medium and at pH 7 represents neutral medium. In the present study pH of chour water was estimated in between 6.8 to 8.1. Shrivastava and Kanungo (2013)¹ reported pH range in between 6.93 to 7.55. Shyamla *et al.* (2008)² reported pH range in between 7.5 to 8.4 while Choudhary *et al.* (2014)³

reported pH range in between 7 to 8.3. Our result agrees with previous result. The value of electrical conductivity in our result ranged in between 166.2 to 191.6. Kataria *et al.* (2011)⁴ reported value of E.C. in between 297 μ mhos/cm to 723 μ mhos/cm while Shrivastava and Kanungo (2013)¹ reported value of E.C. in between 115.11 μ mhos/cm to 212.13 μ mhos/cm in a village pond. Our result differs from both Kataria *et al.* (2011)⁴ and Shrivastava and Kanungo (2013)¹. The value of TDS in our study was observed in between 162.4 to 265.8 which agrees with the result of Garg *et al.* (2006)⁵, Shrivastava and Kanungo (2013)¹ and Dixit *et al.* (2015)⁶. Shrivastava and Kanungo (2013)¹ reported TDS value in between 152.12 to 265.97 ppm while Dixit *et al.* (2015)⁶ reported TDS value in between 165.5 to 254.8 ppm.

The value of DO in our result ranged in between 5.4 to 9.6mg/l. Thirupathaiah *et al.* (2012)⁷ reported value of DO in between 5.18 to 9.72 mg/l which is similar to our result. Our result also agrees with Balamohan and Sheela (2022)⁸.

CONCLUSION

In the present study, physico-chemical parameter of Chour Ambhobasabadi chour was examined in between Jan-2020 to Dec-2020. Among physical parameters temperature, pH, transparency TDS and E.C. were estimated while in chemical parameters alkalinity, DO, BOD, COD, Nitrate, Phosphate and Chloride were estimated.

Among physical parameter, temperature, pH, transparency, TDS and E.C. were examined from Jan-2020 to Dec-2020. Temperature was maximum in the month of June and minimum in the month of January which ranged in between 16.8^oC to 33.4^oC. pH value was maximum in the month of June and minimum in the month of January ranging in between 6.8 to 8.1. Highest transparency was recorded in the month of May and lowest in the month of August. The value of TDS was maximum in the month of May and minimum in the month of January ranging in between 162.4 to 265.8. Electrical conductivity was maximum (191.6 μ mhos/cm) in the month of May and minimum (166.2 μ mhos/cm) in the month of September.

Among chemical parameters, Alkalinity, DO, BOD, COD, Nitrate, Phosphate and Chloride were determined from Jan-2020 to Dec-2020. Alkalinity was maximum in the month of May and minimum in the December ranged

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