



Research Paper

**PHYSICO-CHEMICAL PROPERTIES OF, DIST: BILASPUR (C.G.)
WITH SPECIAL REFERENCE TO PLANKTONS**

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Abstract

The present Disstertation entitled "Physico-Chemical properties of,Dist: Bilaspur (C.G.)with special Reference to Planktons" was conducted with an object to focus light on the water quality as well as the planktons of . The river Arpa is life line river of Bilaspurdistrict . The river water is used for city water supply, human bathing, cattle bathing, sanitation, fish culture, irrigation and for other domestic uses. For physico chemical investigations, water samples were collected from the three sampling sites first up-stream (A1) second confluent point of city sewage into (A2) and third down stream (A3) near Chatidih. Various physico-chemical datas of the river water were analyzed every month as per APHA, 2005 & NEERI, 2005.

INTRODUCTION

Geographical and Physical Status

Bilaspur city is situated 20.09°N 82.15°E in the central part of Chhattisgarh state and surrounded by Korea district in north, Balodabajar, Bhatapara district in South, Korba and JanjgirChampa in East and Mungeli district in West. Arpa is rain-fed perennial river of Chhattisgarh. It originates form Khodri of PendraLormiPathar of high hills of Maikal range of Central India and joints the Shivnath river at Thakur deva in Shivrinarayan. The total length is approximate 100 kilometer. The river flows from north to south and divides the Bilaspur city into East and West parts. The main city lies in the western part of the and receives the city sewage through many drainage and nallah. There are six bridges over to join the different part of Bilaspur city.

The climatic condition is very pleasant and mild in winter season (10°C temperature), the rainy season is medium. The summer is very hot and dry and the average climatic condition is very hot (45°+).

The physico chemical properties of river water and planktonic studies will be conducted about six kilometer of the river in between the Bilaspur city.

Sampling sites

To study the physico chemical property as well the planktons of atBilaspur. The following three sampling stations will be selected and monthly periodical studies were carried out at three stations:

- 1) Confluent of Bilaspur city sewage into near Old sarkanda bridge (A1).
- 2) The second sampling site (A2) two kilometer upstream near Indira Gandhi KrishiMahavidyalaya, Bilaspur.

- 3) The third sampling site (A3) three kilometer away from old sarkanda in downstream near Sanichari, Rapta bridge.

Sample collection

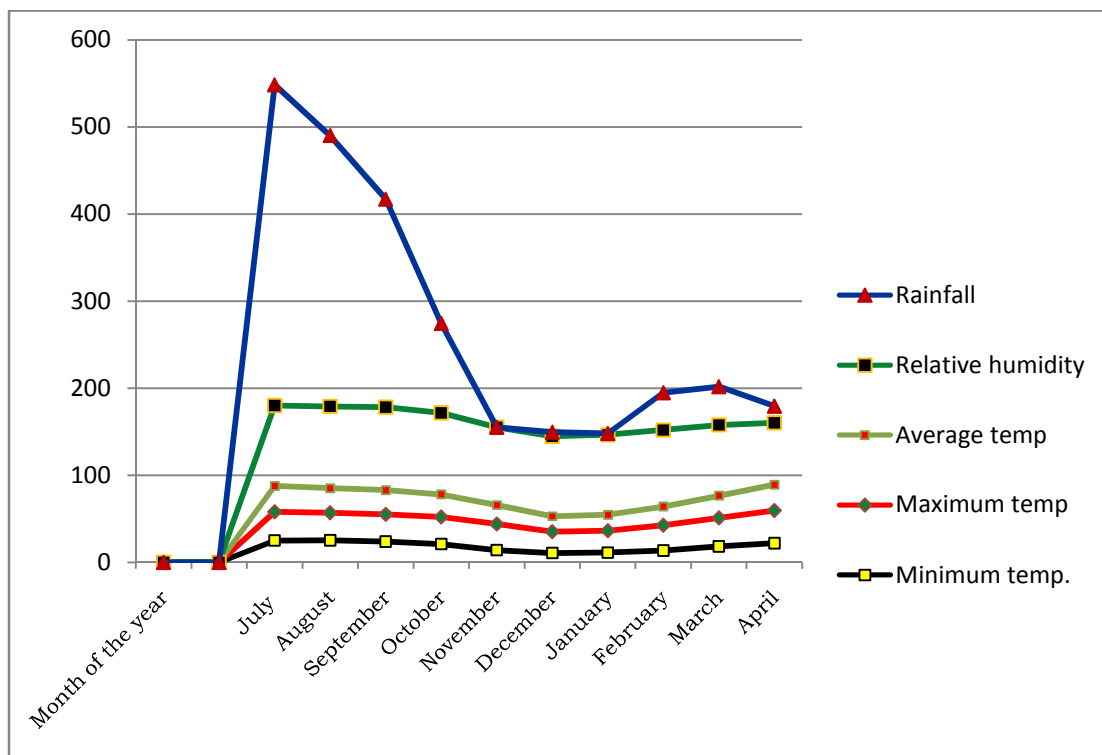
The sub surface (5cm below) water samples will be collected between 8 am to 11am from all the sampling sites, once for every months in each site one year regularly. Some parameters will be calculated on the spot and some in the laboratory within the three hours duration of sampling collection.

Meteorology

The meteorological data such as Temperature, Rainfall and Relative humidity will be noted from Indira Gandhi KrishiMahavidyalaya, Bilaspur in July 2014 – April 2015.

TABLE : 1 Meteorological records in the Year 2014-15

Month of the year	Temp °C			Relative humidity % Average	Rainfall in mm
	Min	Max	Average		
July	25.0	33.1	29.5	92.4	368.4
August	25.3	31.6	28.4	93.7	311.1
September	23.8	31.4	27.6	95.2	239.1
October	21.0	31.0	26	93.6	102.8
November	14.1	29.8	21.9	89.4	0.0
December	10.8	24.5	17.6	91.9	4.8
January	11.2	25.2	18.2	91.8	1.8
February	13.6	29.1	21.3	87.9	43
March	18.4	32.6	25.5	81.2	44
April	21.9	37.6	29.7	71.0	19.2



Graph- 1:Graph of Meteorological records

RESULT AND DISCUSSION

Climates

The climate of Bilaspur can be divided into three main seasons, monsoon from July – Oct. winter season Nov. – Feb., and summer season March – June. The winter season is not very cold in compare to other parts of the state but the summer is very hot, the rainy season has average rain fall.

Air temperature (0°C):

The atmospheric temperature varied 10.8°C to 37.6°C. The minimum temperature 10°C was recorded in the month of Dec. where as the maximum temperature 37.6°C was recorded during the peak summer month of (April). The air temperature increases during the warmer months and decreases during the colder months as shown (Table: 1, Graph - 1).

There was a gradual decline in air temperature from July till it reached its lowest in January. Later, it steadily increases to reach its highest peak in the month of June which subsequently drops in July again.

The air temperature has major role in all biochemical reactions and it also governs the pH, Conductivity, D.O., Alkalinity as well as regulation of productivity of both flora and fauna of aquatic environment.

For aquaculture 15°C-30°C is the suitable and the temperature above 32°C is harmful (Howelles, 1983).

Relative humidity (%)

The relative humidity percentage was recorded maximum 95.2% in the month of Sept., where as minimum 71.0% was recorded in the month of April. During the rainy season the relative humidity was high.

Rain fall (mm)

The maximum rain fall 368.4mm was recorded in the month of July and minimum (0) mm was recorded in the month of November. The rainfall started in June and followed till Oct. There were no rains in the months of November.

WATER ANALYSIS OF ARPA RIVER

Physical Parameter

• Introduction

Physico-chemical quality of water is the main factor for determining the aquatic biota and the primary and secondary productivity of water ecosystem.

Physical quality of water is main factor of aquatic biota as well as primary and secondary productivity of fresh water ecosystem. The study of physical analysis of water is of great significant. The data for physico-chemical properties such as Temperature, Color, pH, Turbidity, Total solids, Suspended solids, Dissolve solids, Dissolve oxygen, BOD, COD, Total alkalinity and Total hardness of water were calculated in separate table.

• Materials and Methods

Water samples were collected from all the three zones at 07:00 AM to 09:00 AM at a depth varying from 5 cm to 15 cm from the surface. A separate sample was collected to calculate the dissolve oxygen. The water temperature and pH were determined in the field with the help of sensitive thermometer and BDH narrow range pH indicator paper respectively. The following Physico-chemical parameters were analyzed according to APHA, 2005 & NEERI, 1979.

The following physical parameters of the three sampling sites A1, A2 & A3 were observed in the year 2014-15

1. **Temperature** – The water temperature of sampling sites were measured at the time of sampling by thermometric method using a thermometer graduated upto 110°C.
2. **Color** - The water colors were examined by visual observation method.

3. **pH** -The hydrogen ion concentration was determined with BDH wide and narrow range indicator paper at the sites during the collection of samples. The results were also verified in the laboratory with the help of portable standard gun type grip pH meter (systronics) which contain glass electrode (corning glass). Before operation, electrode was standardized by buffer solution of 4 and 9.2 pH.
4. **Turbidity** - Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through the samples. The turbidity of water sample was measured by the Nepheloturbidity meter. The value was expressed in terms of N.T.U. (Nepheloturbidity unit). The method is based on a comparison of the intensity of light scattered by a sample and a standard reference under sample condition for this 1 ml of hydrazine sulphate solution (1%) mixed with 5ml of Hexamethylenetetramine solution (10%) and diluted to 1000ml. 10 ml of this solution was diluted in 400 ml forming turbidity standard.
5. **Total solids**- Total solids were measured by Gravimetric method. Take a known volume of a well mixed sample in a tared dish ignited to constant weight (W_1). Evaporate the sample to dryness at 103-105°C for 24 hours. Cool in desiccator, weigh and record the reading (W_2).

$$\text{Total solids, mg/l} = \frac{(W_2 - W_1) \times 1000}{\text{Ml of Sample}}$$

6. **Total Dissolved solids**
Total dissolved solids can be determined either from the difference of the total solids and total suspended solids or transfer filtrate to a weighed (W_1) evaporating dish. Dry for at least one hour in an oven at 180°C, cool and weight (W_2).

Total dissolved solids = Total solids – Total suspended Solids

$$\text{Total Dissolved solids, mg/l} = \frac{(W_2 - W_1) \times 1000}{\text{Ml of sample}}$$

7. **Total Suspended solids**
It was measured by filtration method. Filter a suitable aliquot of sample through a tared gooch crucible ignited to constant weight (W_1) or a glass fibre (GF) filter paper washed with 10 ml of distilled water, dried in a oven at 103-105°C for one hour. Cool in desiccator and weight (W_2).

$$\text{B. Total Suspended solids, mg/l} = \frac{(W_2 - W_1) \times 1000}{\text{Ml of sample}}$$

Chemical Parameter:

• Introduction

Water is an essential material for all living organisms. It is an important natural resource. It has a two fold effect on the aquatic life, one by its physical properties providing medium for location and the other by its chemical properties providing materials for the primary production of plant kingdom.

1. Dissolved Oxygen (O_2)

The DO_2 was measured by Winkler's method, also known as Alsterbergazide modification earlier described by Welch (1948).

Magnus sulphate, alkaline iodide, concentrated sulphuric acid and N/40 sodium thiosulphate solution were used as reagents and starch solution as indicator. Azide (NaNO_3) was used as preservation in the alkaline iodide solution. The value was expressed in mg l^{-1} .

$$\text{Dissolve oxygen mg/l} = \frac{(\text{ml titrant} \times N \times 8 \times 1000)}{V_1 \cdot V}$$

Where,

N = Normality of the sodium thiosulphate

V_1 = Volume of sample titrated

V = volume of alkaline potassium iodide added.

2. Biological Oxygen Demand (BOD)

BOD is the measure of the degradable organic material present in water sample and can be defined as the amount of O_2 required by the microorganisms in stabilizing the biological degradable organic matter under aerobic conditions. BOD is measured by incubating the sample at 27°C for three days.

Incubate the remaining three bottles in BOD incubator at 27°C and after three days incubation estimate the oxygen concentration and recorded it.

BOD was obtained by using following formula:

$$\text{BOD in mg/l} = D_1 - D_2$$

Where,

D_1 = initial D.O. in the sample

D_2 = D.O. after three days

3. Chemical Oxygen Demand (COD)

It is measured by Potassium dichromate method.

Take suitable aliquot of sample in a vessel. Add 0.4g HgSO_4 , 10 ml standard $\text{K}_2\text{Cr}_2\text{O}_7$. Add slowly 30 ml H_2SO_4 containing Ag_2SO_4 mixing thoroughly. Connect the vessel to air condenser. Digest for 2 hour at 150°C in spectra lab digestion apparatus. Cool and add 80 ml distilled water. Titrate excess potassium dichromate with ferrous ammonium sulphate using ferroin indicator. Take as the end point of the titration; the first sharp colour changes from blue-green to reddish brown. Digest blank in the same manner using distilled water instead of sample.

$$\text{COD, ml/l} = \frac{(A-B) \times N \times 8000}{\text{Ml of sample}}$$

Where A = ml Ferrous Ammonium Sulphate used for
Blank

B = ml Ferrous Ammonium Sulphate used for
Sample

N = Normality of Ferrous Ammonium Sulphate
Used for Sample

4. Total Alkalinity

Bicarbonate alkalinity is determined by adding two drops of methyl orange as indicator in the sample and titrated it with diluted sulphuric acid (0.02 N) till change of colour from

yellow to orange. The following formula was used for computing the total alkalinity of the water sample.

$$\text{Total alkalinity (T) as mg/liter} = \frac{\text{Ml of titrant} \times 1000}{\text{Ml of water sample}}$$

5. Total hardness

Total hardness was estimated as method described by APHA (2005). 50ml of sample water was estimated against N/50 EDTA solution (ethylene dinitrotetra acetic acid) using total hardness indicator tablet and ammonia buffer as reagents. The value was expressed in mg l⁻¹.

Calculation was as follows:

$$\text{Total hardness mg/l or in ppm} = \frac{\text{Ml. of EDTA used} \times 1000}{\text{Ml. of sample}}$$

RESULT :

1. Dissolve oxygen (mg/l):

The dissolve oxygen was recorded 5.0–6.6 at (A1) 4.6 – 6.4 at (A2) and 4.8 – 6.6 at (A3). The minimum value of DO in all sampling stations was recorded in the summer (July) and maximum value was recorded in winter season (Dec.).

2. Biological Oxygen Demand (Mg/l):

The biological oxygen demand (mg/l) varied 1.2 –3.4 (mg/l) at (A1) 1.6 – 5.4 at (A2) and 1.4 – 4.8 at (A3). BOD is good indicator of water pollution for assessing the strength of decomposable organic metal present in a water body.

3. Chemical Oxygen Demand (COD) Mg/l

The Chemical Oxygen Demand varied 16 – 36 at (A1), 46 – 70 at (A2) and 32 – 42 at (A3). The highest value of chemical oxygen demand in the month of July was due to less water in river water in high value of organic metal during the decomposition of organic metals and respiration of bacteria more oxygen was used and hence, chemical oxygen demand was high in summer season.

4. Total Alkalinity (Mg/l):

The alkalinity varied 68-84 at (A1), 76-112 at (A2) and 70-104 at (A3) the values of total alkalinity indicated that the hardness of river water is of second category (Philipose, 1960). The higher value of total alkalinity was recorded in early summer and the highest value was in the peak of summer *i.e.* April to Junly. The higher value of total alkalinity recorded at A2 was higher in compare to A1 & A2.

5. Total Hardness (Mg/l)

Total hardness varied 52 – 70 at (A1), 72-98 at (A2) and 74 – 88 at (A3) higher value of total hardness was observed in the month of July.

The degree of hardness is classified in terms of equivalent CaCO₃ concentrations as follows,

60 – 40 mg/l soft water, 60 – 120 mg/l medium water & 120 – 180 mg/l hard water, more than 180 mg/l very hard water (NEERI, 1986). The observation of the river water indicates in medium water category.

CONCLUSION

Physico-chemical conditions of river water :-

- The temperature recorded 10.8°C-37.6°C the minimum temperature was recorded in the month of April and maximum in the month of July.
- The highest rainfall was recorded 368.4mm in the month of July and there was no rain in the month of November.
- The relative humidity was fluctuated 71.0 to 95.2 the maximum humidity was observed in rainy season.
- The river water was alkaline in nature year the whole (7.2-8.1) the maximum pH was observed in summer season and lower data was observed in winter season.
- The turbidity was observed 52NTU to 135.5 NTU, the minimum was observed in the month of April and maximum of July.
- The total solid was observed 270-770mg/l, the minimum in April and maximum in the July.
- Total solids observed 72 – 735 mg/l, the minimum data in April and maximum in the July.
- Dissolve solids was also recorded in April (198)mg/l and maximum July (336) mg/l.
- DO (mg/l) minimum 4.6 in July and maximum 6.6 in December.
- BOD (mg/l) 1.2 in month of April and 5.4 in the month of July.
- COD (mg/l) observed minimum 16 in month of April and maximum 70 in the month of July.
- Total alkalinity (mg/l) observed in minimum 68 in the month of April and maximum 112 in July.
- Total hardness (mg/l) observed 52 in December 98 in the month of July.

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