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SEASONAL VARIATIONS IN PHYSICO-CHEMICAL CHARACTERISTICS OF CHULBAND RIVER - SOUNDAD, GONDIA DISTRICT, (M.S.) INDIA.

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Abstract:
Seasonal Variations in physico-chemical parameters were carried out during the two years Feb.2010 to Jan-2012 from Chulband River at Soundad in Gondia District. The various parameters such as Velocity, Temperature, Turbidity, Transparency, TDS, TSS, TS, pH, DO, BOD, CO_2, Hardness, Calcium, Magnesium, Chloride and Phosphorus were analysed. The results revealed that there was significant alterations in the physicochemical parameters and some of the parameters were in the normal range and Turbidity, DO, BOD and Phosphorus results are indicated not good quality of river water. Turbidity of rainy and summer seasons are exceeding 11 to 14 times as per WHO and BIS standard. DO, BOD and Phosphorus results were exceed the limit of WHO and ISI. Our findings highlighted the deterioration of water quality in the river due to industrialization, discharge of domestic, agricultural and human activities. To improve quality of water there should be continuous monitoring of pollution level and maintain the favourable conditions essential for aquatic organism's survival, growth and reproduction.
Keywords: Seasonal Variations, Physico-chemical parameters, Chulband River, Soundad.

Introduction

Freshwater ecosystems are considered as one of the most important natural resources for the survivability of all the living organisms of the biosphere. Rivers have always been the most important freshwater resources along the banks of which our ancient civilizations have flourished and most developmental activities are still dependent upon them. River water finds multiple uses in every sector of development like agriculture, industry, transportation, aquaculture, public water supply etc (Shiddamallayya and Pratima, 2008). Water quality has direct relation with aquatic productivity (Moses, 1983; Shrestha and Kazama, 2003). Aquatic organisms need a healthy environment. Maximum productivity depends on optimum level of physicochemical parameters (Sadia et al., 2013). Biological assessment is a useful alternative for evaluating the ecological quality of aquatic ecosystems since biological communities integrate the environmental effects of water chemistry (Shahare, 2016). Assessment of riverine water was carried out by assessment of its physicochemical parameters (Rao and Vaidyanadhan, 1979; Muniyan and Ambedkar, 2011).

Cherian and Shahare (2011) studied earlier on "Pollution, a threat to conservation of biodiversity in fresh water body of Chulband River, Gondia dist., Maharashtra". Shahare and Cherian (2012) worked on "Study of Cyanophycean diversity at Chulband Dam, Gondia Dist. (M.S.) India". Shahare (2015) studied Assessment of Physico-Chemical parameters of Chulband dam in Gondia District. (MS), INDIA. Shahare (2016) earlier studied on Physico-Chemical analysis of Chulband River at Dodake-Jambhali, Gondia District. (MS), INDIA. Chulband River makes its origin from various small and large streams scattered in the forest hilly areas of eastern part of Gondia district. It flows in the Jambhali forest area for few kms and then enter in the Chulband dam towards Chulband River at Soundad which the present study was undertaken.

Materials and Methods

The present investigation at Soundad location is (Latitude. 21˚04"47.58' N & Longitude. 80˚06"19.30' E) and Fig. 1.

Sampling and Analysis of Water

The study was carried for a period of 2 years (February 2010 to January 2012). Monthly data was collected, but results were represented average mean season wise. The water samples were collected between 9.00 AM to 11.00 AM from sampling site in pre-cleaned, BOD bottle, sterilized polythene containers of one litre capacity and brought to the laboratory for the analysis of various physico-chemical parameters. Water velocity, temperature, pH, Turbidity and Transparency, were recorded immediately on the spot. The following physico-chemical parameters were analyzed TDS, TSS, TS, pH, DO, BOD, CO_2, Hardness, Calcium, Magnesium, Chloride and Phosphorous. The parameters were analysed by using standard procedures described in APHA (1998), IAAB (2006) and Water Velocity (http://www.geography-site.co.uk) method.

Fig.I Chulband River, Soundad, Gondia district. (MS.)

Result and Discussion:

In the present investigation, considerable variation in average mean seasonwise physico-chemical parameters is presented in Table no.1.

Velocity: Water stream average mean velocity of the seasonwise summer, rainy and winter are 0.0, 0.56 and 0.10 m/sec respectively (Graph.1). The stream velocity was lowest at summer season (0.0 m/s) stagnant water and highest at rainy season (0.56 m/sec) with significant variation. Seasonal variation in water current has been reported in streams of Palani hills (Sivaramkhrishhnan and Venkataraman, 1990).

Temperature: Hutchinson (1957) suggested that meteorological conditions are responsible for seasonal changes in temperature. In the present study average mean water temperature ranged from minimum 24.88°C in winter season to the maximum 29.50°C in rainy season (Graph.2) similar reports were observed by Salve and Hiware (2008). The water temperature depends on geographical location and meteorological condition.

Turbidity: The average mean turbidity value for winter season, summer and rainy season are Negligible, 118.00 and 146.50 respectively was recorded (Graph.3). As per WHO and BIS standard (10 NTU) our results of rainy and summer seasons are exceeding 11 to 14 times. Turbidity is a measure of water clarity how much the material suspended in water decreases the passage of light through the water. Turbidity was higher which was because of rains bringing the sediments from the adjoining areas and due to turbulent flow which stirred up the nonliving matter like silt and sand at the bottom of the river during rainy seasons. However, other seasons may affects due to low level of water content and high anthropogenic activities along the river water.

Transparency: For transparency, high seasonal variation was found in the studied location. The descending trend of transparency is found in the present study as winter > rainy > summer. The average mean value for winter season, rainy and summer are 29.98, 20.79 and 16.32 cm respectively. (Graph.4).

TDS (Total Dissolved Solids): Total Dissolved Solids indicates the salinity behaviour of river water. The mean average TDS value during the period of investigation was ranged between 172.63 mg/L winter season and 260.50 mg/L in rainy season (Graph.5). The higher TDS was depends on the natural sources, location, and geology of the river. Similar trend was reported by Shinde et al., (2010) in Savangi dam, district Aurangabad.

TSS (Total Suspended Solids): The average mean Total Suspended Solids (TSS) of the water samples was minimum 101.00 mg/l at winter season and maximum 125.13 mg/l at the rainy season (Graph.6).

TS (Total Solids): TS ranged between average mean 273.63 mg/l in winter season and 385.63 mg/l in rainy season. (Graph.7). TS of the water causes the reduction in light penetration, ecological balance and ultimately affects the water quality. It may affect the osmotic regulation of aquatic fauna.

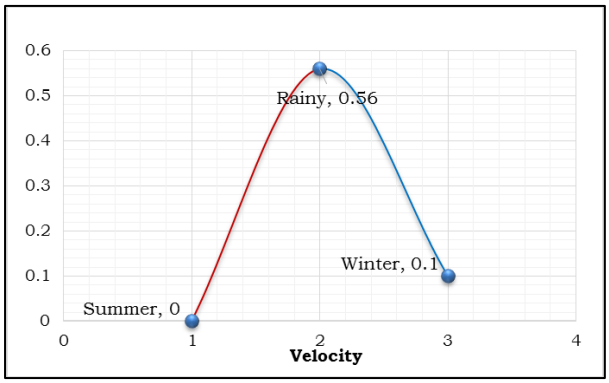
pH: The maximum mean average pH was recorded in summer 7.43 and minimum was in rainy season 7.00. (Graph.8). Similar reports were observed by Bobdey (2002) had recorded pH values between 7.0 to 8.50 in the river Wainganga at Pauni, Maharashtra.

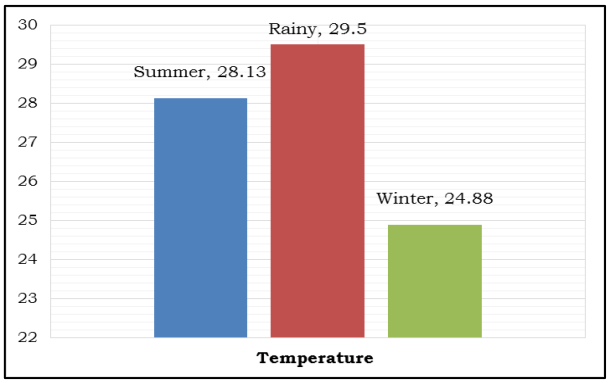
DO (Dissolved Oxygen): DO in water bodies depends on various factors like climatic conditions, partial pressure of gases, dissolved salts, stream velocity, relative solubility, photosynthetic activity of plants, respiration by aquatic microbes, plants and animals (Zutshi and Vass, 1978). In the present investigation mean DO varied between 5.63 mg/L in rainy season, 6.88 mg/L in summer season and 6.44 mg/L in winter season (Graph.9). The WHO standard recommended DO is 5 mg/l while ISI 3 mg/l. Our results were exceed the limit of WHO and ISI.

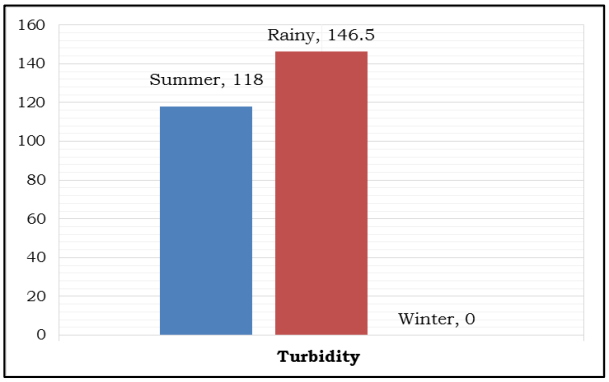
BOD (Biochemical Oxygen Demand): BOD is an important parameter that indicates the magnitude of water pollution by oxidizable organic matter. The main sources of organic pollution include untreated domestic sewage, agricultural runoff, and containing residual fertilizers. In the present research seasonal mean BOD was maximum 11.88 mg/L in winter season and minimum 5.14 mg/L in summer season (Graph.10). 5 mg/l is the permissible limit of water recommended by WHO. Our results were exceed the limit of WHO.

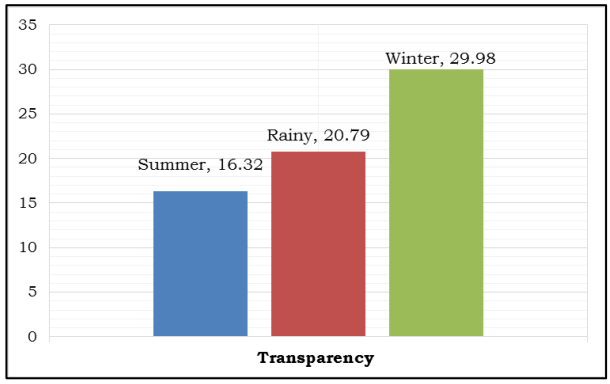
Table No.1: Seasonal variations in physico-chemical parameters of, Chulband River, Soundad (M.S) India. (During Feb. 2010 – Jan. 2012)

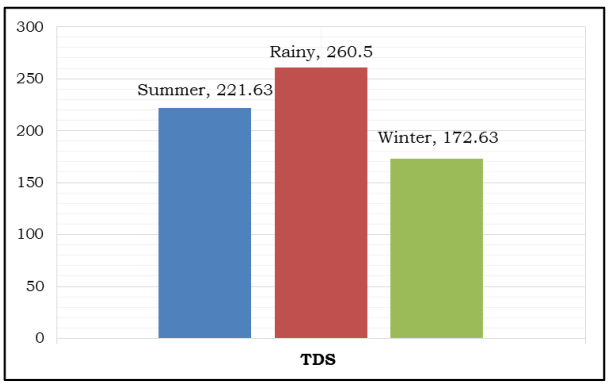
Parameters	Range	Summer	Rainy	Winter
Velocity	0.0-1.157	0.0	0.56±0.16	0.10±0.08
Temperature	20-32	28.13±1.47	29.50±0.63	24.88±1.32
Turbidity	112-360	118.00±27.39	146.50±49.24	0
Transparency	6.35-42.84	16.32±1.48	20.79±5.21	29.98±1.39
TDS	118-302	221.63±7.65	260.50±12.50	172.63±13.32
TSS	59-164	107.50±8.55	125.13±10.52	101.00±9.09
TS	228-437	329.13±13.92	385.63±14.72	273.63±11.62
pH	6.4-8	7.43±0.13	7.00±0.13	7.29±0.04
DO	5.1-8.3	6.88±0.47	5.63±0.11	6.44±0.28
BOD	2.3-16.7	5.14±0.67	7.84±1.06	11.88±1.09
CO_2	4.7-14.6	13.34±0.37	7.44±0.83	6.76±1.00
Hardness	37.4-144.28	78.30±5.28	71.10±14.07	79.78±5.51
Calcium	11.22-60.92	28.63±3.42	28.35±6.97	25.91±2.34
Magnesium	12-83.36	49.68±5.40	42.74±8.09	53.88±5.15
Chloride	30.5-81.65	49.10±2.94	45.23±7.71	38.98±0.75
Phosphorus	0.5-2.1	1.15±0.17	1.46±0.13	1.33±0.14

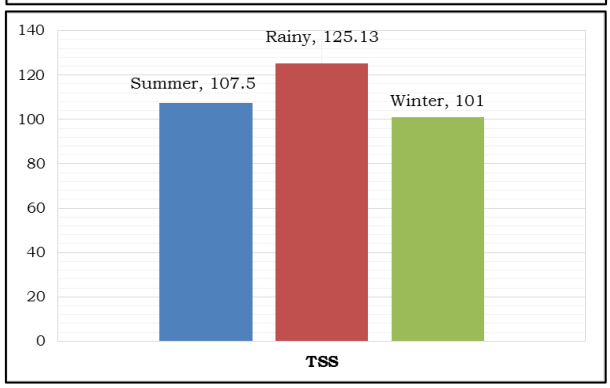


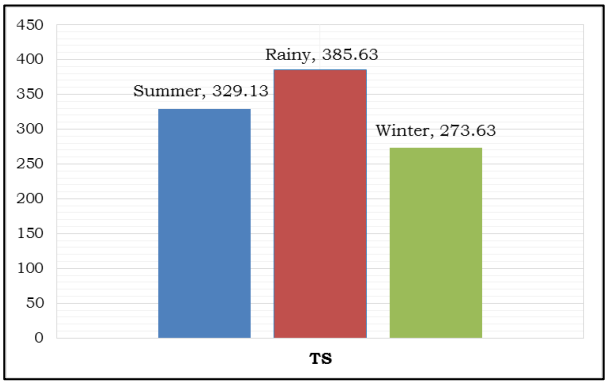


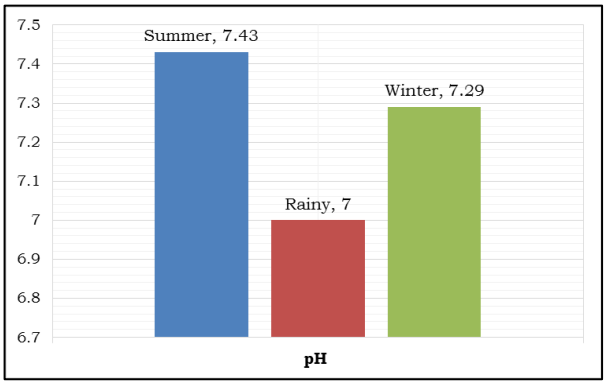


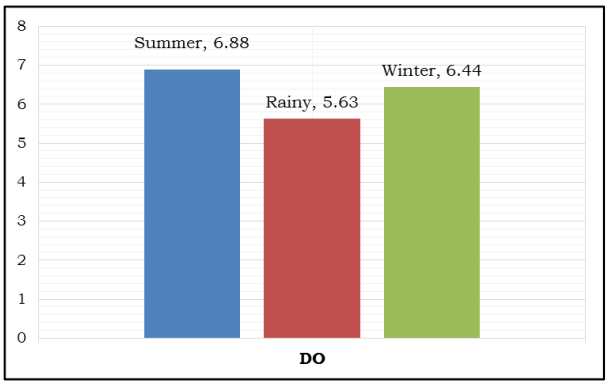


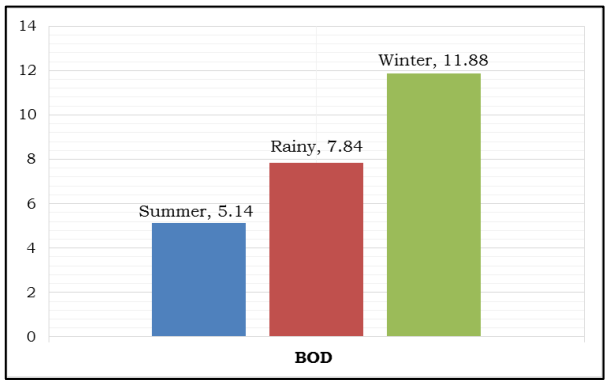


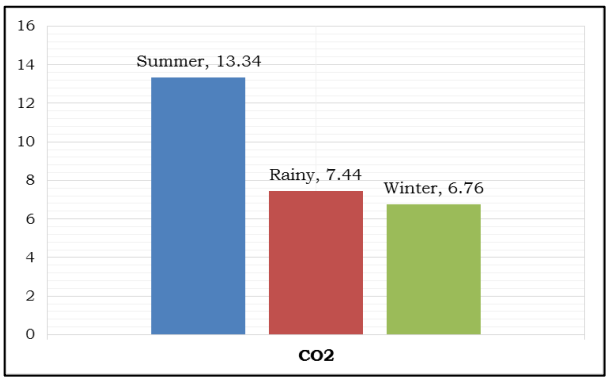



450
400
350
300
250
200
150
100
50
0
Summer, 329.13
Rainy, 385.63
Winter, 273.63
TS


7.5
7.4
7.3
7.2
7.1
7
6.9
6.8
6.7
Summer, 7.43
Rainy, 7
Winter, 7.29
pH


8
7
6
5
4
3
2
1
0
Summer, 6.88
Rainy, 5.63
Winter, 6.44
DO


14
12
10
8
6
4
2
0
Summer, 5.14
Rainy, 7.84
Winter, 11.88
BOD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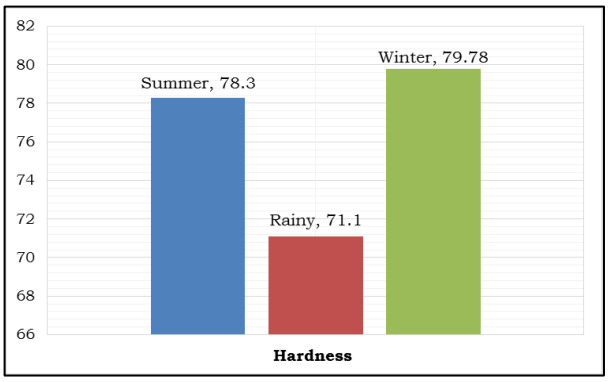
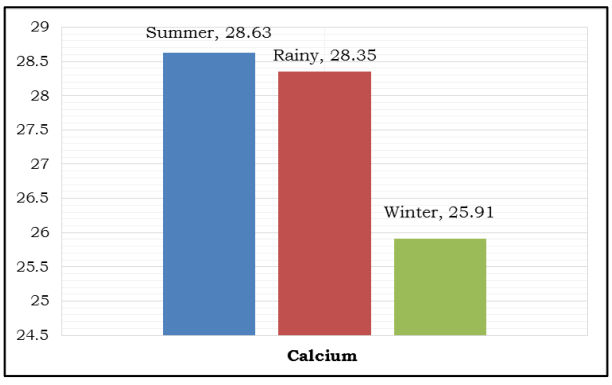
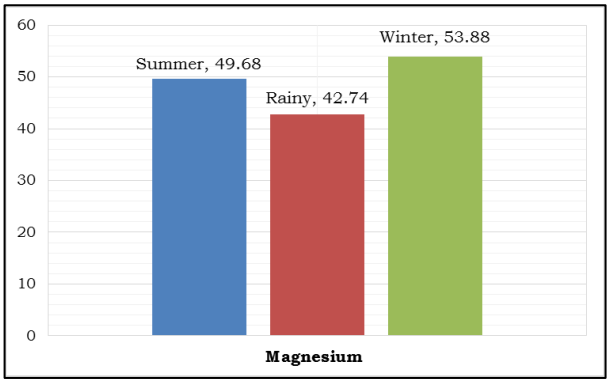
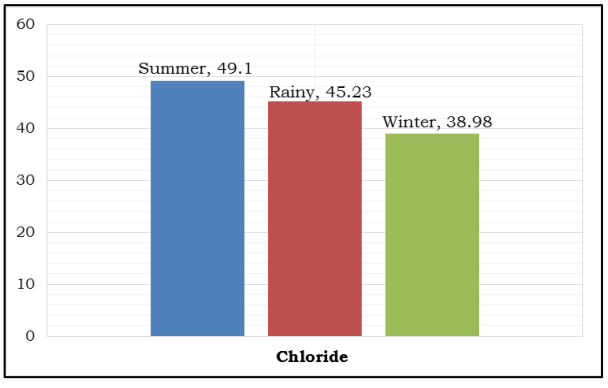
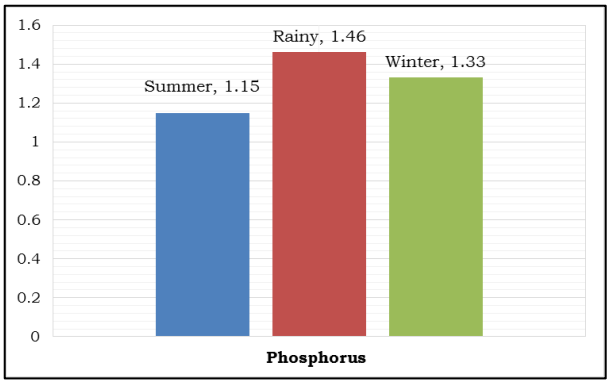
14
12
10
8
6
4
2
0
Summer, 13.34
Rainy, 7.44
Winter, 6.76
CO2


82
80
78
76
74
72
70
68
66
Summer, 78.3
Rainy, 71.1
Winter, 79.78
Hardness


29
28.5
28
27.5
27
26.5
26
25.5
25
24.5
Summer, 28.63
Rainy, 28.35
Winter, 25.91
Calcium


60
50
40
30
20
10
0
Summer, 49.68
Rainy, 42.74
Winter, 53.88
Magnesium


60
50
40
30
20
10
0
Summer, 49.1
Rainy, 45.23
Winter, 38.98
Chloride


1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Summer, 1.15
Rainy, 1.46
Winter, 1.33
Phosphorus

CO_2 (Carbon Dioxide): The CO_2 of the water sample varied between 6.76 mg/l in winter season, and 13.34 mg/l in summer season. (Graph.11). The CO_2 level mostly governs by the available algae as well as diffusion through atmospheric air.

Hardness: Hardness was found to fluctuate between 71.10 mg/l in rainy season and 79.78 mg/l in winter season (Graph.12). Hardness of water is not a pollution parameters but indicating water quality mainly in terms of Ca++ and Mg++ expressed as $CaCO_3$. The increase in hardness can be attributed to the decrease in water volume and increase in the rate of evaporation at high temperature (Kaur and Sharma, 2001)

Calcium: The average mean Calcium of the water samples was minimum 25.91 mg/l at winter season and maximum 28.63 mg/l at the rainy season with similarly 28.35 mg/l at the summer season (Graph.13). The presence of calcium in the water is more likely in the form of carbonate, which is also indicated by high values of hardness in water samples.

Magnesium: Magnesium is an essential element for all living organisms as it takes part in chlorophyll biosynthesis and enzymatic transformation (Weztel, 1975). The average mean Magnesium of the water sample varied between 42.74 mg/l in rainy season and 53.88 mg/l in winter season. (Graph.14).

Chloride: In the present study, Cl^- concentration varied from 38.98 to 49.15 mg/L, minimum in winter and maximum in summer (Graph.15). Similar reports were observed by Shinde et al., (2010) in Harsool-Savangi dam, (M.S) India. (During. High value of chloride and calcium in drinking water are generally not harmful to human being but high concentration of chloride may affects a person who already suffers from diseases of heart and kidney.

Phosphorus: Phosphorus is the essential elements for increase in productivity of biological produce (Hutchinson, 1957). The Phosphorus of the water sample varied between 1.15 mg/l in summer season and 1.46 mg/l in rainy season (Graph.16). WHO and ISI recommended Phosphorus level as 0.1 to 1.0 mg/l for drinking water. Our results were exceed the limit of WHO and ISI.

Conclusion:

During study, water sample from of Chulband River, Soundad, Gondia district (M.S) were collected for the period of 2 years (Feb 2010 to Jan 2012) and season wise analysis of various physico-chemical parameters had been carried out. The results revealed that there was significant alterations in the physicochemical parameters and some of the parameters were in the normal range and Turbidity, DO, BOD and Phosphorus results are indicated not good quality of river water. Our findings highlighted the deterioration of water quality in the river due to industrialization, discharge of domestic, agricultural and human activities. To improve quality of water there should be continuous monitoring of pollution level and maintain the favourable conditions essential for aquatic organism's survival, growth and reproduction.

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