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Limnological Study of Sheonath River Near Sheonath Temple Durg (C.G.) India

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Abstract: ***The influence of physico-chemical properties of Sheonath river were investigated for one year from June 2014 to May 2015. Analysis of physico-chemical parameters like water temperature, pH, rainfall, DO, BOD, EC, Total alkalinity, Total hardness, chloride, SO_4, Fe has been made during the investigation period. Results reveal all parameters are within the permissible limits. It was quite evident from the findings that the quality of river water near Sheonath temple was suitable for drinking, agriculture purposes.***

Keywords: Physico-chemical factors, Sheonath temple, Sheonath river

1. Introduction

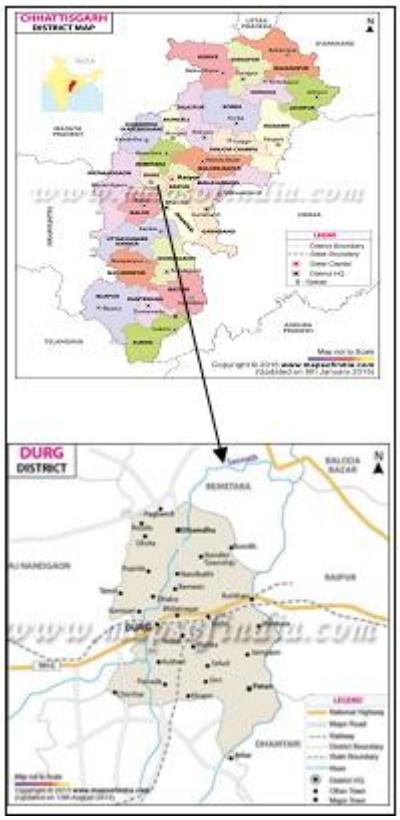
Water is a basic and most essential life sustaining substance. Rivers are large natural stream of water emptying into the ocean and they considered important fresh water resource for human beings. However, since many years, they have also been utilized for many activities of the human beings. River water contain only about 0.0001% of the total amount of water in this world. The river water generally collected from precipitation through surface runoff.

In recent years because of continuous population growth, rapid urbanization, load of wastes from industries, domestic sewage, and agricultural waste leading to deterioration of water quality. Water quality assessment is critical for pollution control and the protection of surface and ground waters leading to the outbreak of water borne diseases such as cholera, paratyphoid, diarrhea, amoebic dysentery and hepatitis .Biodegradable organic matter is the contamination is concern for dissolved oxygen concentration which is the principal indicator of pollution of surface water.

In many places, both surface and ground waters are fouled with industrial, agricultural and municipal wastes and according to the World commission on water for the 21st century, more than half of the World, major rivers are so depleted and polluted that they endanger human health and poison surrounding ecosystems.There is progressive deterioration of water quality throughout the world. The causative factors responsible for degrading water quality need to be evaluated so as to take proper steps before the situation becomes worst.

2. Materials and Methods

Major part of the district is drained by Sheonath, Hamp, Kharr and Tendula river and their tributaries. Major surface water sources in the district is Tendula canal/ system and the total irrigated area is 100703 ha. Geologically, 87% of the total geographical area of the district is covered by sedimentary formations of Chhattisgarh Super group comprising gypsiferous sale, Chandi limestone, Gunderdehi shale, Charmuria limestone, Chandarpur sandstone and Archaean granite gneisses. The assessment of physico-chemical factors was carried out for one year i.e,. from June 2014 to May 2015.



Map 1: Location map of Chhattisgarh and study area of Durg district.

Photograph 1 showing Sheonath river at Durg.

Sampling site was selected near Sheonath temple of the river district Durg, located latitudes $20^0$23'N and $22^0$02'N and the longitudes $80^0$48'E and $81^0$57'E. Samples were collected monthly during 7.30 am to 9.00 am and this was uniformly maintained throughout the study period. Collected water samples were brought to the laboratory for analysis of physico-chemical factors and biological factors following the procedures of standard methods APHA, 1998 and methods for Pollution studies (Trivedy and Goel 1984). Physico-chemical parameters such as temperature, pH were measured at site only. Remaining parameters such as dissolved oxygen, biochemical oxygen demand, EC, total solids, sodium, potassium, total hardness, calcium, magnesium nitrate iron and fluoride were analyzed in the laboratory. Data for rainfall obtained from District Statistical Office. After analysis statistical application such as standard deviation, simple correlation coefficient test was used.

3. Results and Discussion

The data on physico-chemical analysis has been presented in Table 1, seasonal variations of Physico-chemical parameters were presented in Table 2 & Simple correlation test was presented in Table 3.

Table 1: Monthly variations in Physico-chemical factors of Sheonath Temple of Sheonath river during 2014-15

Parameters	Jun.14	Jul.14	Aug.14	Sept.14	Oct.14	Nov.14	Dec.14	Jan.15	Feb.15	Mar.15	Apr.15	May15
Temp.	21	22	21	21	23	23	25	28	28	29	30	30
Rainfall	127.7	85.8	81.7	82.5	119.9	00	00	00	00	00	16.2	4.6
pH	7.7	7.9	7.6	7.4	7.2	8.1	7.2	7.3	7.0	7.1	7.16	7.5
BOD	0.8	0.72	0.6	0.7	0.4	0.34	0.44	0.62	0.92	1.0	1.0	0.9
DO	8	6.8	7.8	7.4	8.7	7.6	7.3	8.2	7.4	7.1	6.8	6.3
TDS	120	142	144	120	126	100	152	312	310	260	230	290
EC	180	200	210	180	190	162	210	480	460	380	340	440
Cl	40	50	56	72	58	40	36	44	80	86	68	52
Na	6	17.1	16.0	18.0	18.0	26.6	25	34	20	25	30	41.0
K	2.0	2.1	1.8	2.0	1.9	6.0	1.8	6.0	2.0	3.0	1.0	4.5
SO_4	10	20	22	24	20	17	20	16	12	6	18	45
TH	55	101	30	62	46	92	90	78	120	94	104	110
Ca	10.1	15.6	8.8	16.0	10.1	16.4	18.2	13.0	26.0	24.0	22.0	24.0
Mg	3.59	4.15	1.95	5.34	5.04	9.47	8.86	6.19	13.36	6.07	6.07	4.86
NO_3	4.8	8.0	10.0	14.0	6.0	8.0	4.0	2.0	4.0	7.1	8.0	2.0
Iron	0.24	0.16	0.20	0.80	0.10	0.2	0.16	0.2	0.17	0.8	0.9	1.0

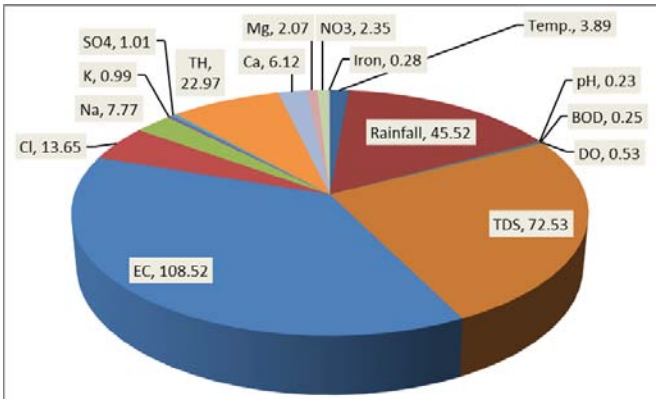
The physico-chemical factors of natural water body may vary substantially at different seasons of the study period. The factors contributing to such changes include topography of the area, atmospheric precipitation by rain and other meteorological forces in and around water body.

Temperature is an important physical parameter of the water body which regulates natural process within the environment and governs physiological function in organism (Negi *et al.* 2006). According to Mishra and Tripathi, 2003 fast microbial decomposition followed by release of energy could one of the reasons for increased temperature. In the present study temperature fluctuate between 210C to 30 0C. Maximum temperature was recorded in the month of April and May. Minimum temperature was observed in June August and September. Temperature is an important physical parameter of the water body which regulates natural process within the environment and governs physiological function in organism (Negi *et al.*, 2006). Seasonally as usual maximum in summer and minimum in monsoon. Temperature is significantly correlated with BOD, TDS, EC, Sodium, Total hardness and iron. It is also negatively correlated with rainfall, pH and nitrate

pH is a variable parameter which serves as an important index for the degree of pollution. In the present investigation the pH was alkaline throughout the study period and values ranged between 7 and 8.1. Similar values recorded in Perumal lake of Cuddalore (Usha *et al.*, 2006). Maximum pH recorded in November and lowest value recorded in February. Seasonally maximum pH is recorded in monsoon and minimum was in summer.

Table 2: Average seasonal variations in Physico-chemical factors of Sheonath Temple of Sheonath river during 2014-15.

Parameters	*Monsoon*	*Winter*	*Summer*	*SD*
Temp.	21.5	24.7	29.25	±3.89
Rainfall	93.45	29.97	5.2	±45.52
pH	7.65	7.45	7.19	±0.23
BOD	0.70	0.45	0.95	±0.25
DO	7.5	7.95	6.9	±0.53
TDS	131.5	172.5	272.5	±72.53
EC	192.5	260.5	405.0	±108.52
Cl	54.5	44.5	71.5	±13.65
Na	14.27	25.9	29.0	±7.77
K	1.97	3.92	2.62	±0.99
SO_4	19.0	18.25	20.25	±1.01
TH	62.0	76.5	107.0	±22.97
Ca	12.62	14.42	24.0	±6.12
Mg	3.75	7.39	7.29	±2.07
NO_3	9.2	5.0	5.27	±2.35
Iron	0.35	0.16	0.71	±0.28



Graph.1 : Average seasonal variations in Physico-chemical factors of Sheonath Temple of Sheonath river during 2014-15.

Dissolved oxygen is required for living organisms to maintain their biological process. Dissolved oxygen has been attributed a great significance as an indicator of water quality. DO conc entration in water is mainly dependent upon temperature, dissolved salts velocity of wind, pollution load etc (Zutshi *et al.*, 1990). In the present study, DO values were recorded 6.3 mg/l to 8.7 mg/l. Maximum Do was recorded in October where temperature was less and minimum Do was 6.3 mg/l recorded in May where the temperature was highest. Seasonally it is less values recorded in summer, solubility of oxygen decreases with increase in temperature. Similar observation recorded in river Mosam (Shastri, 2000). Dissolved oxygen is essential for sustaining the plant and animal life any aquatic system. If DO level drops below the level necessary to sustain normal life then the aquatic system is classified as polluted. Dissolved oxygen is negatively correlated with BOD.

Table 3: Simple correlation coefficient test between physico-chemical factors of Sheonath Temple of Sheonath river during 2014-15.

Parameters	Temp.	Rainfall	pH	BOD	DO	TDS	EC	Cl	Na	K	SO_4	TH	Ca	Mg	NO_3	Iron
Temp.	1.00															
Rainfall	-0.76*	1.00														
pH	-0.57*	0.28	1.00													
BOD	0.57	-0.20	-0.40	1.00												
DO	-0.46	0.45	-0.04	-0.58	1.00											
TDS	0.87**	-0.65**	-0.58*	-0.61	-0.31	1.00										
EC	0.87**	-0.65**	-0.55*	-0.59	-0.28	0.99	1.00									
Cl	0.36	0.12	-0.59*	0.64	-0.22	0.40	0.38	1.00								
Na	0.78**	-0.77**	-0.19	0.14	-0.46	0.63	0.64	-0.08	1.00							
K	0.22	-0.47	0.37	-0.27	0.06	0.26	0.31	-0.35	0.56	1.00						
SO_4	0.11	-0.04	0.17	-0.05	-0.43	0.07	0.08	-0.23	0.52	0.16	1.00					
TH	0.70**	-0.72**	-0.16	0.46	-0.70**	0.57*	0.56*	0.21	0.55*	0.19	0.08	1.00				
Ca	0.77**	-0.73*	-0.42	0.62*	-0.73**	0.64*	0.62*	0.54*	0.54*	0.02	0.09	0.88**	1.00			
Mg	0.37	-0.63*	-0.31	-0.02	-0.07	0.33	0.33	0.11	0.21	0.16	-0.25	0.63*	0.60	1.00		
NO_3	0.52*	0.39	0.23	-0.07	-0.01	-0.59*	-0.59*	0.33	-0.42	-0.37	-0.09	-0.38	-0.22	-0.28	1.00	
Iron	0.55*	-0.27	-0.24	-0.65*	-0.66*	0.33	0.33	0.47	0.49	-0.03	0.39	0.31	0.56*	-0.18	0.18	1.00

Biochemical oxygen demand is an indicator parameter to know the presence of biodegradable matter and express the degree of contamination.BOD values ranged from 0.4 to 1.00 mg/l. Higher values of BOD were noted during summer months due to favorable environmental conditions for microbial activities at higher temperature. This is in concurrence with the findings of Halali reservoir (Tamot *et al.* 2008). An inverse correlation relationship occur with DO.

Total dissolved solid is a measure of the solid materials dissolved in the river water. This includes salts, some organic materials. Waters with higher solids content have laxative and sometimes the reverse effect upon people whose bodies are not adjusted to them. TDS consist of oxygen demanding wastes, disease causing agents, which can cause immense harm to public health. TDS values are ranged between 100 mg/l to 312 mg/l. Higher values are recorded from January to May. According to various workers, in many natural water bodies of India, TDS is proportional to the degree of pollution (Bharathi and Krishnamoorthy, 1990). High values of TDS in drinking water are generally not harmful to human beings but high concentration of these may affect persons suffering from kidney and heart diseases. TDS values in the study area are well within the limits of drinking water standards. Thus, water is potable and may be utilized for human and animal consumption.

Electrical conductivity is a numerical expression of the ability of an aqueous solution to carry an electric current. As most of the salts in the water are present in the ionic form, are responsible to conduct electrical current. EC values are ranged from 162 to 480µ mhos/cm. Maximum value 480 µ mhos/cm and minimum value 162 µ mhos/cm recorded. The higher value was recorded during summer and lower during monsoon. Similar findings recorded in Mula dam of Rahuri (Dhembare, 2011).

Chlorides are generally present in natural waters. The presence of chloride in natural waters attributed to dissolution of salt deposits. Chloride values are ranged from 36 to 86 mg/l . Maximum values of chloride observed in summer (March) and minimum values recorded in post monsoon (December). (Munawar, 1970) has suggested that the higher value is an indication of animal origin pollution.

High values of chloride may be associated with high temperature and less DO. Seasonally high values of chloride recorded in summer and associated with high temperature. In the present study values are well below the permission limits. Chloride is negatively correlated with pH and positively correlated with BOD.

Sodium in fresh waters occurs through weathering of rocks. Sodium quantities varied between 6 mg/l to 41 mg/l. High quantity of sodium makes the salty taste of water making unfit for human consumption but in the present study values are below the permissible limit. Potassium is a cation which occurs in natural waters in low quantity and play important role in the metabolism of fresh water environments and considered to be important macronutrient. Values varied between 1 to 6.00 mg/l.

Sulphate itself has never been a limiting factor in aquatic ecosystems. Sulphate ion is one of the important anion present in natural water and produce cathartic effect on human beings when present in excess amount (Srinivas, *et al.* 2002). In the present study sulphate value was 6 to 45 mg/l. Lower values observed in monsoon season. This may be due to the dilution of river water and higher values because of runoff water from agricultural lands. Seasonally higher values recorded in summer, this may be due to the mixing of effluents from the surrounding villages.

Total hardness of the river water fluctuated between 30 mg/l to 120 mg/l The trend of variation was non-uniform in all the seasons but values increased in summer season. The results indicate that values are below the permissible limits, showing their suitability for drinking.

Calcium is found in great abundance in all natural waters as its main source is weathering of rocks from which it leaches out. Values of calcium are varied between 10.1 mg/l to 26 mg/l. The present findings reveal that calcium content was higher in summer and lower in monsoon months. Similar findings recorded in Almatti reservoir (Hulyal and Kaliwal, 2011). Magnesium values are very less compared with the calcium. Calcium and magnesium play an important role in antagonizing the toxic effects of various ions. Similar observations recorded in temple pond of Kerala (Chandrasekhar and Jafer, 1998).

Domestic sewage contains very high amount of nitrogenous compounds, runoff from agricultural fields is also contain nitrate. Unpolluted natural water contains usually only minute amount of nitrate. The main source of the nitrate is the decomposition and biodegradation of organic matter. The nitrate level was from 2 to 14 mg/l. In monsoon values are more due to excessive rainfall. Similar results are noticed in Muvathupuzha river, Kottayam (Dist) Kerala (Joseph and Shanti, 2009). Such lower quantities also observed in Almatti reservoir of Karnataka (Hulyal and Kaliwal, 2011).

Presence of iron in considerable amounts in water imparts colour and develops turbidity when exposed to air, consequently water becomes unacceptable for drinking. Iron values in the present study were 0.2 to 1.00 mg/l. Values were found below the permissible limits for drinking water. Fluoride and chromium are totally below the detectable limits.

4. Conclusion

Most of the parameters analysed in the Sheonath river Durg (C.G.) were in acceptable range. The river at this point is suitable for drinking, bathing, recreation, irrigation purposes. Thus, it can be concluded that the river water is within the safe limits and is fit for consumption. People, particularly those living along the banks of river, should realize that the river is for them and they are for the river and not a waste disposal site. Anthropogenic activities must be reduced.

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