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Physico-Chemical analysis of water of Narmada River at Chandan Ghat Dindori district (M.P.)

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Abstract
Water is the basic necessity for a living being and detritions in the quality of water led to many harmful impacts. Water is regarded as 'polluted' when it is changed in its quality or compositions, directly or indirectly as a result of human activities, so that it becomes less suitable for drinking, as well as domestic and other purposes. Pollution of fresh water results largely from the waste disposal. Most of the rivers have become darkened with sewage, chemicals and other undesirable foreign extraneous matter. Moreover, the rivers carry and deposit their pollutants in to the ocean. Hence, the oceans are also polluted by toxic wastes which cause contamination of sea-foods on a large-scale. The present study has been made to analyze the physicochemical parameters of the Chandan ghat, Narmada River. Samples were collected season wise from sampling site for analyzing the various physicochemical parameters such as Temperature, pH, TDS, Conductivity, DO, free CO_2, Sulphate, Phosphate, Nitrate, BOD, COD. The work highlights the condition of this river water in various seasons with respect to the parameters mentioned above.

Keywords: Physico-chemical parameters, Narmada River, Dindori, pollution

1. Introduction
Water is a resource that has many uses, including recreation, transportation, and hydroelectric power, domestic, industrial, and commercial uses. Water also supports all forms of life and affects our health, lifestyle, and economic well-being. Although more than three quarters of the earth's surface is made up of water, only 2.8 percent of the Earth's water is available for human consumption (Iskandar, 2010) [1].

Fresh water is a finite resource, essential for agriculture, industry and even human existence, without fresh water of adequate quantity and quality, sustainable development will not be possible (Kumar**,** 1997) [2]. Rivers play a major role in assimilation or carrying off of municipal and industrial wastewater and runoff from agricultural land, the former constitutes the constant polluting source whereas the latter is a seasonal phenomenon (Muduli, *et al.* 2010) [3].

A majority of developing countries are in the tropical zone and have fast growing human population. Therefore, there is constant increase in the demand of food, fuel, fiber, medicine and constructions. It results in the exploitation of natural resources. In many countries including India, the rivers are not only being exploited but are also used as dumping places for effluents, sewage and solid wastes. Direct or indirect contact of chemicals or waste water to the sources of drinking water cause the undesirable changes in it which becomes dangerous for all living things. Considerable investigations of physico-chemical properties of the river water are carried out in India (Borse *et al.* 2003, Singh and Gupta 2004, Barai and Kumar 2012, Deshmukh 2012, Chaurasia and Karan 2013, Majumder and Dutta 2014) [4-9].

A water body affects the environment in its vicinity, like charging of ground water tables, conditions of climate etc. Most of the people like washer man, and fisherman, living in the surrounding area depend on this source of water for their survival. Any damages to this water source by any agency will not only make life miserable but that will also disrupt the aquatic ecosystem. It is therefore necessary to study the quality of river water, on the basis of physico-chemical parameters so as to assess its potability.

2. Materials and Methods

A general survey of the river was made for the study of various abiotic parameters. Water has unique property of dissolving and carrying suspension, a huge variety of chemicals, has the undesirable consequence that water can easily become contaminated (APHA 1989) [10]. Water samples were collected monthly in clear glass bottles from surface (max. depth 20 cm) sites of the river. Water samples were collected in three replicates from surface, column and bottom and mean values of all three observations were taken into consideration. For BOD estimation, water samples were collected separately in dark bottles. The acquisition of meaningful data demands correct sampling and storage procedures. The preservation of samples were done by refrigeration at 4°C, which is most general accepted method. Water and air temperature were recorded with a digital centigrade thermometer on the date of sampling.

Physico-chemical parameters like water temperature, pH, DO, free Carbon-di-oxide, total alkalinity and conductivity were measured in the field. Other parameters were mostly tested within 24 hrs of collection. A total of 12 limnological parameters of water *viz*., temperature, pH, DO, BOD, COD, Free CO_2, total alkalinity, conductivity, TDS, Phosphates, nitrate were determined. All the parameters were analysed the standard methods (Golterman 1969, Michael 1984, Trivedy and Goel 1986 and APHA 1989) [11, 12, 13, 10] and spectrophotometer SQ 118.

3. Results and Discussion

The present study was conducted at selected sampling station of Chandan ghat, Narmada River at Dindori district for a period of one year (from Jan 2020 to Dec. 2020). Covering three main seasons i.e. Rainy (July/August/ September), winter (Dec/Jan/Feb) and Summer (Apr/ May/June) in a year.

Physico-chemical and bacteriological parameters were carried out in the samples collected from the study area to study the drinking water quality and pollution level and details of the same was given in table-1 to show the seasonal fluctuations of selected parameters (table-1).

Table 1: Physico-chemical properties of Chandan ghat, Narmada River for the duration Jan. 2020-Dec.2020.

S. No.	Parameters	Rainy Seasons	Winter seasons	Summer seasons	Mean	SD
1.	Temp. (°C)	28.9	21.2	30.4	26.83	4.94
2.	Transparency (cm.)	91	112	86	96.33	13.80
3.	T.D.S. (mg/l)	379	283	321	327.67	48.35
4.	Conductivity	374	275	411	353.33	70.32
5.	pH	7.5	8.6	7.9	8.00	0.56
6.	Alkalinity (mg/l)	136	174	196	168.67	30.35
7.	D.O. (mg/l)	7.6	9.2	5.15	7.32	2.04
8.	B.O.D. (mg/l)	13.9	9.16	29.8	17.62	10.81
9.	C.O.D. (mg/l)	119.4	139.8	82.2	113.80	29.21
10.	Nitrates (mg/l)	0.029	0.022	0.023	0.02	0.00
11.	Phosphates (mg/l)	0.049	0.067	0.071	0.06	0.01
12.	Sulphate	17.3	12.9	18.91	16.37	3.11

To assess the quality of river, Indian drinking water quality standard IS 10500 (1990) has been adopted. The data harvested during the present study is given in table 1. The present data showed the seasonal variations of all the parameters during the study period.

The water temperature is one of the important parameter in river. In the present study of Narmada River, difference in the fluctuation of water temperature was maximum 30.4°C to 21.2°C with a standard deviation of 4.94. The season wise studies showed the increased temperature of the river during summer is due to the common effect of intensity of solar radiations, ambient temperature. Decreased values of temperature during winter days are due to low ambient temperature (Gyananath *et al.* 2000) [14].

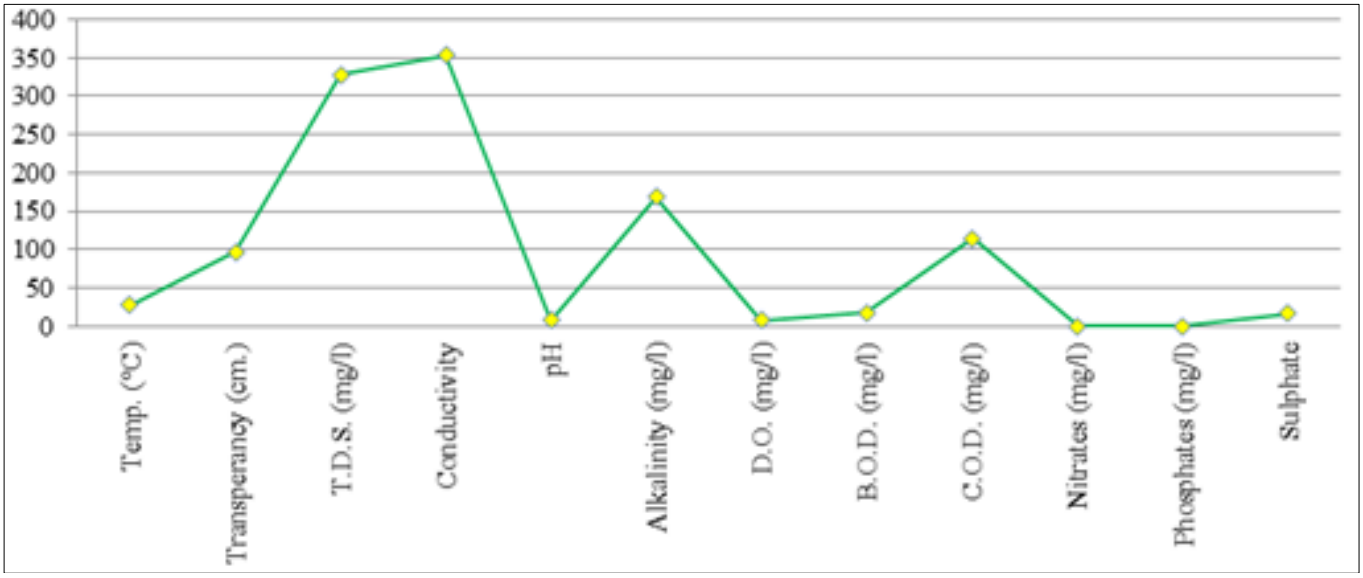

Fig 1: Graphics Average water analysis of Chandan ghat, Narmada River

Transparency is light penetration capacity of the water. The color of water is due to concentration of suspended organic and inorganic particles. Transparency varied from maximum 112 cm to 86 cm. with a standard deviation of 13.80. The less transparency observed during rainy season and summer season. While during winter comparatively the water showed more transparency. Low transparency in summer and rainy season in the different water bodies in Jammu (Shashi and Raina 1990, Kaushik and Saksena 1999 and Sharma 2015) [15-17].

Total dissolved solids include salt and variety of organic substances, which readily dissolve in water and often impart a degree of hardness. The value of total dissolved solids ranged between max 379 mg/ltr to min 283 mg/ltr with a standard deviation of 48.35. The maximum seasonal value is observed in rainy season and minimum value in winter season. Moreover the low value of total dissolved solids in summer and high in rainy season was also observed (Trivedy *et al.* 1984) [18].

The ionic status of water determines the conductivity. During summer and rainy days the enhanced values of conductivity may be due to presence of carbonates and bicarbonates in the water in more quantity due to pollutants. The exchange of inorganic ions by increased micro flora during the winter showed the moderate values of conductivity during the winter period.

Hydrogen ion concentration is considered as a important ecological factor, which is a result of interaction of various substances in water and in numerous biological phenomenon. Nearly neutral pH of water is regulated by carbon dioxide and bicarbonates (Hutchinson, 1957) [29]. The river water showed well alkaline water through the study period. pH of river ranges between 7.5 to 8.6.

Total alkalinity in river water ranges from 136mg/l to 196mg/l with a standard deviation of 30.35. During the summer season the higher values of hardness were observed and lower values during winter season (Ugale and Hiware 1999, Pratibha *et al.* 2005 and Sharma 2015) [20-21, 17].

Dissolved oxygen is also one of the important factors of water quality, which influences the biota present inside the river water. The seasonal fluctuation of dissolved oxygen in water bodies (Adebisi 1981) [22]. Similar pattern of DO observed in the present study, it decreases during the hot days of summer. DO show the inverse relationship with the temperature in river water.

Biological oxygen Demand is a direct measure of O_2 requirement and indirect measure of biodegradable organic matter. The maximum B.O.D. was 29.8mg/l in summer and minimum 9.16mg/l in winter season. (Seenaya and Zafar 1979 & Sharma 2015) [23, 15].

Chemical Oxygen Demand indicates the extent of chemical pollution mainly from industrial effluents. The C.O.D. values observed maximum in winter and minimum in rainy season (Singh and Roy, 1995 & Sharma, 2015) [24, 15]. In the present study, nitrate values ranged between 0.029 to 0.022 mg/l maximum of nitrate values were reported during rainy season and summer and minimum during winter. The high value of nitrate in rainy season, which is linked to heavy run-off of the organic matter from the catchments (Gohram, 1961) [25].

Phosphate concentration in river water ranged between 0.071mg/l to 0.049mg/l. more concentration of phosphates recorded during the summer and winter season. It may be due to deposition of ashes and bones under religious activities and decomposition of organic matter in the water sediments.

Sulphate is produced by biological oxidation of sulphur content of organic matter. The sulphate value ranges between 18.91mg/l to 12.9mg/l with a standard deviation of 3.11. Minimum concentration of sulphate was in winter and maximum in summer (Angadi *et al.* 2005 & Sharma 2015) [26, 15].

Test of significance of the observed correlation coefficient

The correlation coefficient study is very useful to determine a predictable relationship which can be exploited in practice. It is used for the measurement of the strength and statistical significance of the relation between two or more water quality parameters. Hence, it is a helpful tool for the promotion of research activities (Shrivastava and Joshi, 2008 and Borkar and Tembhre, 2018) [27-28]. The correlation coefficients (r) among the various physicochemical characteristics of Effluents from recycled Orient paper mill, Amlai have been calculated and the numerical values are tabulated as shown in Table-2.

Table 2: Correlation Matrix of Physico-chemical properties of Chandan Ghat, Narmada River for the duration Jan. 2020-Dec. 2020

S.No.	Temp.	Transparency	T.D.S.	Conductivity	pH	Alkalinity	D.O.	B.O.D.	C.O.D.	Nitrates	Phosphate	Sulphate
Temp.	1											
Trans-perancy	-1.00	1										
T.D.S.	0.70	-0.68	1									
Cond-uctivity	0.99	-1.00	0.61	1								
pH	-0.87	0.85	-0.96	-0.81	1							
Alkal- inity	0.00	-0.03	-0.71	0.11	0.50	1						
D.O.	-0.88	0.90	-0.28	-0.93	0.53	-0.47	1					
B.O.D.	0.78	-0.80	0.10	0.85	-0.37	0.62	-0.98	1				
C.O.D.	-0.86	0.87	-0.23	-0.91	0.49	-0.51	1.00	-0.99	1			
Nitrates	0.48	-0.46	0.96	0.38	-0.85	-0.88	-0.01	-0.17	0.03	1		
Phos-phates	-0.20	0.17	-0.84	-0.09	0.66	0.98	-0.29	0.46	-0.33	-0.95	1	
Sulphate	0.99	-1.00	0.62	1.00	-0.81	0.11	-0.93	0.84	-0.91	0.38	-0.09	1

In the Correlation Matrix of Physico-chemical properties of Chandan ghat, Narmada river, out of 78 correlation coefficients, 36 negative and 42 positive correlation coefficients. In Table-2, the highly positive correlation is observed between Sulphate and conductivity (1.00), Conductivity and Temperature (0.99), Sulphate and Temperature (0.99), Phosphate and alkalinity (0.98), Nitrates and TDS (0.96) and DO and Transparency (0.90), where highly negative correlation is observed between Transparency and Temperature (-1.00), Conductivity and Transparency (-1.00), COD and BOD (-0.99), BOD and DO

(-0.98), Phosphate and Nitrate (-0.95), DO and Conductivity (-0.93) and COD and Conductivity (-0.91).

4. Conclusion

The objective of this research work was to find the quality of Chandan ghat, Narmada river water w.r.t drinking purpose. From the experimental results of water quality analysis of Narmada River, it can be concluded that the water quality is good and most of the parameters are within the limits set by organizations like WHO and Bureau of Indian Standard (BIS). From the above study, it may conclude that except little variation, all the physico-chemical parameters were in permissible limit at the study site of the Chandan Ghat, Narmada River. It is suggested that proper measures are necessary to avoid contamination as water is used for drinking purpose. At present the river is suitable for irrigation and fishery purpose.

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