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Seasonal Variations in Physico-Chemical Properties of Narmada River in Dindori Madhya Pradesh, India

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Abstract: 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 river Narmada. 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.

I. INTRODUCTION

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).

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.

II. MATERIAL 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). 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, turbidity, 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) and spectrophotometer SQ 118.

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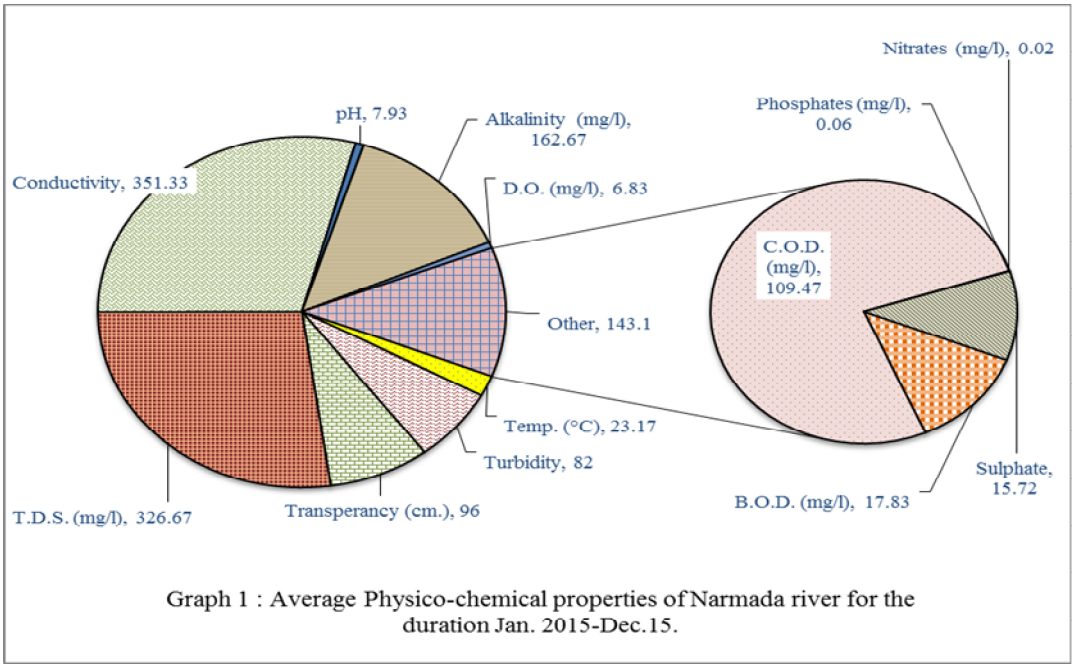
III. RESULT AND DISCUSSION

The present study was conducted at selected sampling station of Narmada River at Dindori town for a period of one year (from Jan 2015 to Dec. 2015). 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 Narmada river for the duration Jan. 2015-Dec.15.

S.No.	Parameters	Rainy Seasons	Winter seasons	Summer seasons	Mean	SD	p
1.	Temp. (°C)	23.9	18.2	27.4	23.17	4.64	14.38
2.	Turbidity	66	96	84	82.00	15.10	152.00
3.	Transperancy (cm.)	90	113	85	96.00	14.93	148.67
4.	T.D.S. (mg/l)	377	285	318	326.67	46.61	1448.22
5.	Conductivity	370	276	408	351.33	67.95	3078.22
6.	pH	7.6	8.5	7.7	7.93	0.49	0.16
7.	Alkalinity (mg/l)	133	163	192	162.67	29.50	580.22
8.	D.O. (mg/l)	7.3	9.1	4.10	6.83	2.53	4.28
9.	B.O.D. (mg/l)	13.3	9.10	31.1	17.83	11.68	90.94
10.	C.O.D. (mg/l)	118.5	138.7	71.2	109.47	34.64	800.18
11.	Nitrates (mg/l)	0.028	0.021	0.024	0.02	0.00	0.00
12.	Phosphates (mg/l)	0.043	0.066	0.070	0.06	0.01	0.00
13.	Sulphate	16.5	11.8	18.85	15.72	3.59	8.59



Graph 1 : Average Physico-chemical properties of Narmada river for the duration Jan. 2015-Dec.15.

To assess the quality of river, Indian drinking water quality standard IS 10500 (1990) has been adopted. The data harvested during

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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 27.4°C to 18.2°C. 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).

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 113 cm to 85 cm. 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 and Kaushik and Saksena, 1999). 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 377 mg/ltr to min 285 mg/ltr. 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). 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). The river water showed well alkaline water through the study period. pH of river ranges between 7.6 to 8.5.

Total alkalinity in river water ranges from 133mg/l to 192mg/l. During the summer season the higher values of hardness were observed and lower values during winter season (Ugale and Hiware, 1999 and Pratibha, *et al.* 2005).

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). 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 31.1mg/l in summer and minimum 9.10mg/l in winter (Seenaya and Zafar, 1979).

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). In the present study, nitrate values ranged between 0.028 to 0.021 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).

Phosphate concentration in river water ranged between 0.070mg/l to 0.043mg/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 18.85mg/l to 11.8mg/l. Minimum concentration of sulphate was in winter and maximum in summer (Angadi, *et al.* 2005).

IV. CONCLUSION

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 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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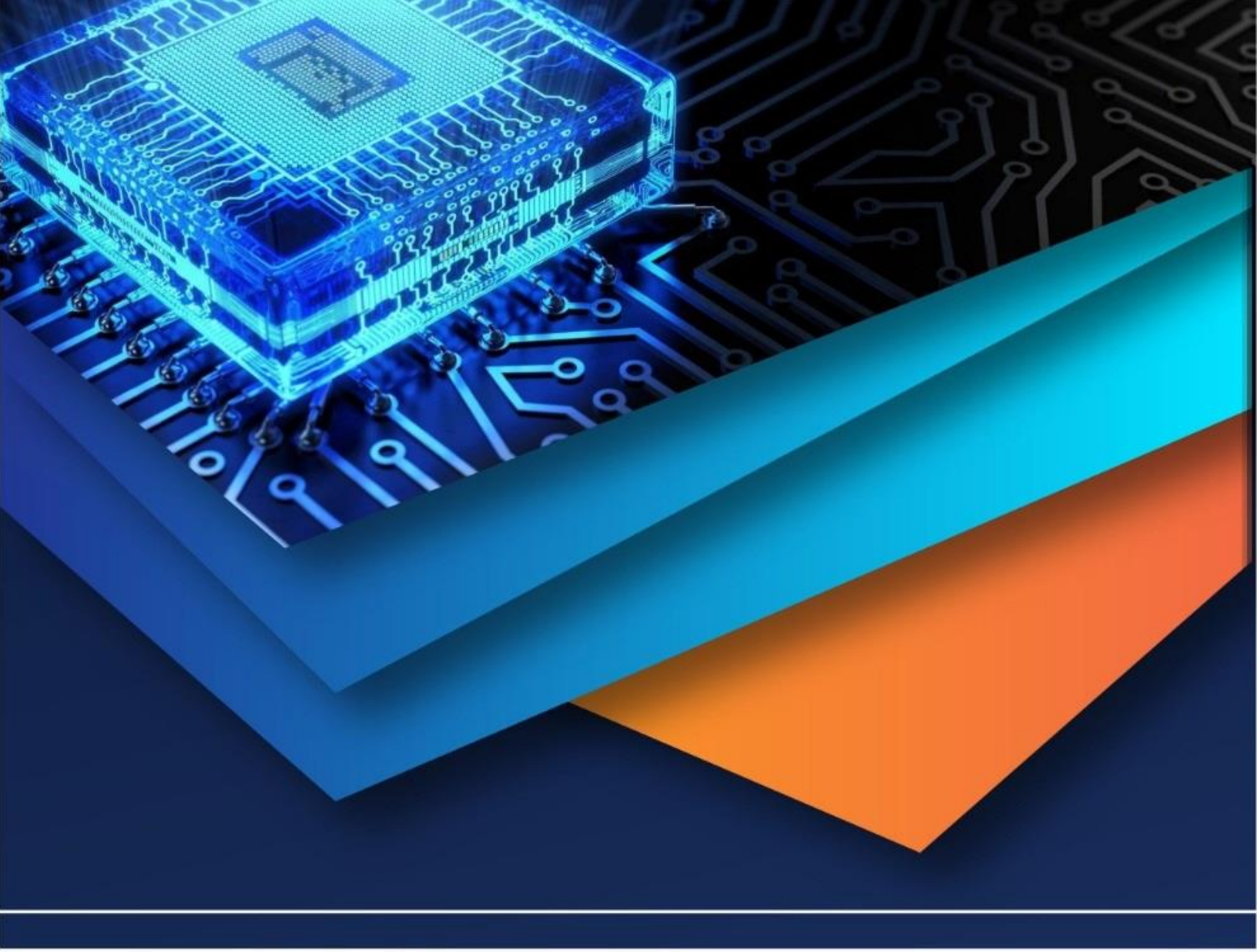

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