PHYSICO- CHEMICAL PARAMETERS OF NARMADA RIVER AT GADARWARA DISTRICT (M.P.) INDIA

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ABSTRACT

Fresh water is necessary for healthy living. River water is used for a variety of purposes such as drinking, bathing, irrigation etc. This natural resource is being polluted by disposal of sewage, industrial waste and human activities which affect quality of river water. Therefore, it is necessary for monitoring the water quality of river by analysis of various physicochemical parameters. The present study was carried from October'2015 to May'2016 to enumerate the various Physico-chemical parameters of Narmada river. Water samples were taken season wise from sampling site for analyzing the various physicochemical parameters such as Temperature, pH, TDS, Conductivity, DO, Sulphate, Phosphate, Nitrate and Heavy metal. The results indicated that most of the Physico- chemical characteristics of Narmada water samples were within the WHO limits.

Keywords: Physico-chemical parameters, Narmada River, Gadarwara.

1. INTRODUCTION

The origin of Narmada is from Amarkantak a small place in Madhya Pradesh with lush green hills. This river has both religious and economical importance. It is considered as daughter of Shiva. Water is one of the major necessities of life required for growth and activity of all living beings in the world. Narmada River flows from numerous big cities of Madhya Pradesh (Shukla and Bhandari, 2015). The NarmadaRiveris a River of Central India in Indian subcontinent. It forms the traditional boundary between North India and South India. Narmada "the backbone of Madhya Pradesh" is the largest Westward flowing River of India. It is also referred as 'lifeline of Madhya Pradesh'. It is considered holy by Hindus. Water is one among the prime necessities of life required for growth and activity of all living beings on globe. Only small amount of water that occurs in fresh water rivers, streams, lakes and tanks is available for the terrestrial life (Wetzel 1975).

India is blessed with good rainfall and water resources. There are eighteen major river basins and they account for 84% of the total drainage area. The demand for water by various user sector and one hand is increasing day by day while on the other the abuse and misuse is increasing manifold. Several aspects of hydrobiology and pollution of Indian rivers have been investigated by various authors like Ganapathi and Chacko (1951) on Gadavari, David (1956) on Bhadra: Chakraborty -et.a1. (1959) on Jamunat Laksminarayana (1965) on Ganga; Rai (1974)on Yamuna; Olaniya -et.al. (1976) on Gometi; Ram Rao et.al.(1977) on Khan; Sampathkumar (1977) on Moosi; Sharma (1979) on Bhagirathi; Govindan and Sundearesan (1979) on Adiyar ; Prasad and Manjula (1980) on Gomati; Sharma G.G. et al. (1981) on Yamuna; Paramasivam and

Sreenivasan (1981) on Cauvery ; Sornashekar (1981) on Cauvery and Kapila ; Venkateswarlu and Sheshadri (1981) on Krishna; Mitra (1982) on Godavari; Kribhne and Tungabbadra; Braj Nandan Prarad and Singh (1982) on Gomati; Ghanvat (1983) on Krishna; Rajkulaar (1984) on Manjira; Bhatt –et. al . (1985) on Koshi; Bhowmick –et. al .(1985) on Ganga; Ajmal and Khan (1985) on Kalinadi; Dora Roy (1988) on Subernarekha; Shukla - et. al . (1989) on Ganga; Manikya Reddy - et. al. (1991) on Tungabhadra and Singh and Singh (1994) on Ganga. Sastry et.al. (1972) and Dubey (1980) had a survey of river pollution.

Studies of Physico–Chemical characteristics of River Narmada water suggests that the various parameters depending upon the hydrochemistry of the study area. The Physical factors contributing the great role in water quality such as Temperature, pH and Turbidity water level and intensity of illumination is also an important factor to maintain the water quality. The pH of water is directly related to carbonate and bicarbonate ions present in it, which is closely associated with CO_2 pressure and the ionic strength solution and altering the pH values change the quality of water have been activities in the aquatic solutions.

The results achieved during the course of present study are tabulated in Tables- 1 and 2. The result of Physico-Chemical properties obtained during present study was found fluctuated with the standard values of water quality given by World Health Organization, BIS (Bureau of Indian Standards) to categories the sites according to their pollution load.

2. MATERIALS & METHODS

The sample site selected was Gadarwara, Dist.-Dhar M.P. The Narmada River water samples were collected in 2 litre polythene jerry canes for physico-chemical studies (Fig.1). The water samples were collected from five selected locations A1 (Confluence point at Shakkar River), A2 (KakaraGhat – Narmada River), A3 (Kakara Ghat – Narmada River {upstream region}), A4 (KakaraGhat – Narmada River {downstream region}) and A5 (Confluence point at Narmada River) for a period of six months. The river water samples were collected in different sampling bottles as per standard method APHA. The pH, electrical conductivity and turbidity were estimated at sampling sites. The other parameters were measured by the procedure given by APHA in the laboratory. The investigation period was divided into two seasons i.e. Pre-monsoon and Monsoon. The Physico- Chemical parameters were determined by standard methods of APHA (2002), Welch (1998), Golterman (1991).

3. RESULT & DISCUSSION

a)Atmospheric Temperature

Atmospheric temperature values observed in the present study was shown in Fig.2.The present investigations of atmospheric temperature was varying between from 24^o C to 32^{o}C. The maximum value was recorded at station A2 and minimum at station A3. Maximum value of water temperature was observed in pre-monsoon season and minimum in post-monsoon season.

b)Water Temperature

Temperature is one of the most important factors which influence the aquatic ecology (Huet,1986). Water temperature value observed in the present study area was shown in Fig-3. The present investigations of water temperature was varying between 24^o C to 29 ^{0}C. The maximum value was recorded at station A1 and

minimum at station A4. Maximum value of water temperature was observed in pre-monsoon season and minimum in post-monsoon season. Sharma et al (2001), Yogesh et al (2001) also reported the same type of fluctuation in various freshwater bodies.

c) pH

The pH of water is controlled by the amount of bicarbonate, carbonates and dissolved carbon dioxide in water and majority of organisms prefer a pH 6.5 to 9.0 as pH levels changes beyond would affect the animal physiology. The pH of Narmada river water samples in Pre monsoon season was found to be in the range 7.2 to 8.9 and in Post monsoon 7.6 to 9.2 as shown in Fig-4. pH value were ranged 7.0 to 8.9. The maximum value was recorded at station A5 and minimum at station A1. These values are within maximum permissible limited prescribed by WHO (1993). Our results tally with the findings of Sharma et al (2004).

d) Dissolved Oxygen

Dissolved Oxygen (DO) refers to the volume of oxygen that is contained in water. Oxygen enters the water as rooted aquatic plants and algae undergo photosynthesis, and as oxygen are transferred across the air-water interface. The amount of oxygen that can be held by the water depends on the water temperature, salinity and pressure. Gas solubility increases with decreasing temperature (colder water holds more oxygen).The Dissolved Oxygen an important parameter in assessing water quality because of its influence on the organisms living within a body of water. DO an important limnological parameter indicating level of water quality and organic pollution in the water body (Wetzel and Likens, 2006).The investigated DO value was varying between 4.4 mg/l and 5.6 mg/l. and is shown in Fig.5. The minimum value was recorded (4.4 mg/l) at station A3 and the maximum (5.6mg/l) dissolve oxygen was recorded in at Station A5 in post-monsoon. The present study reports a gradual decrease in DO from winter to summer. The seasonal variation of DO in water depends upon the temperature of the water body which influences the oxygen solubility in water.

e) Nitrite

Nitrite is an intermediate oxidation state of nitrogen. In aquaria and ponds, nitrites are produced by *Nitrosomonas* bacteria when ammonia is broken down. The concentration of Nitrite in Narmada River water sample in Pre monsoon and Post-Monsoon was found to be in the range of 0.059-0.078 mg/l and 0.068-0.081 mg/l and is shown in Fig-6. Maximum nitrite (0.081 mg/l) concentration was observed at station A5 during Post monsoon and minimum (0.059 mg/l) at station A1 during Pre monsoon respectively.

f) Nitrate

Although nitrates occur naturally in soil and water, excess levels of nitrates can be considered to be a contaminant of ground and surface waters. Most sources of excess nitrates come from anthropogenic activities. The source of excess nitrates can usually be traced to agricultural activities, human wastes, or industrial effluents. Nitrate concentration in the entire stretch observed in a range of 0.285- 0.516 mg/l. The concentration of nitrates in Narmada river water sample in Pre monsoon and Post-Monsoon was found to be in the range of 0.285-0.382 mg/l and 0.362-0.516 mg/l and is shown in Fig.7. Maximum nitrate (0.516 mg/l) concentration was observed at station A5 and minimum (0.285 mg/l) at station A2. Nitrate is attributed mainly due to anthropogenic activities such of run of water from agricultural lands, industrial wastes,

discharge of house hold and municipal sewage from the market place and other effluents containing nitrogen. Such observations were also reported by Royer et al (2004).

g) Phosphate

Phosphate deposits and phosphate-rich rocks release phosphorus during weathering, erosion, and leaching process. Phosphorus may also be released from lake and reservoir bottom sediments during seasonal overturns. The increased application of fertilizers, use of detergents and domestic sewage greatly contribute to the heavy loading of phosphorous in the water. The concentration of Phosphate in Narmada River water sample in Pre monsoon and Post monsoon was found to be in the range of 0.18-0.26 mg/l and 0.22- 0.34mg/l and is shown in Fig.8. Similar values were also observed by Jain (2000). The increased use of fertilizers, use of detergents and domestic sewage greatly contribute to the heavy loading of phosphorus in the water.

h) **Turbidity**

Turbidity of water is an important parameter, which influences the light penetration. The turbidity value of Narmada River water sample in Pre monsoon and post monsoon was found to be in the range of 12.17- 23.6 and 22.7-30.64 NTU and is shown in Fig.9. The turbidity in the River Narmada at A2 was lowest during Pre monsoon season. From monsoon season onwards the water became turbid due to rains. The maximum turbidity 30.64 NTU was observed in Post monsoon season and minimum 12.17 NTU was observed in Pre monsoon season. Jain and Sharma (2000) also reported lowest turbidity in pre rainy season and maximum in post monsoon.

i)Heavy metal

Rapid urbanization and industrial development during last decade have provoked some serious concerns in environment. Heavy metal contamination in river is one of the major quality issues in many fast developing cities, as the maintenance of water quality and sanitation infrastructure did not increase along with population and urbanization growth especially for the developing countries. An attempt has been made in the present study to evaluate and extent of distribution of the selected heavy metal (copper, zinc, chromium, cadmium and lead). The data were collected would be useful in assessing the impact of heavy metal distribution would be helpful for future management of River Narmada (Fig.10 to 14).

Considering the importance of heavy metal estimation in pollution study, in recent years, there has been a great spurt of renewed activity to identify the sources and sinks of these metals in various aquatic environments. The fate of heavy metals in river, lakes and near shore environment is of the extreme importance due to their impact on aquatic life at elevated concentrations (Yu *et al.*, 2001; Jain *et al.*, 2008). The distributions of heavy metal concentrations are given in Table.1 and 2. The lower concentration in dissolved metals in Pre monsoon season (May) is due to the absence of substantial amount of contaminants from the nearby agricultural and industrial area. The concentration of dissolved metals increased to high concentration during Post monsoon months. It may be attributed to the rainfall, monsoon floods and land drainage etc. which brings large volume of water with heavy metals, both in dissolved as well as associated form into the river. Similar reports were also made by Jakir Hussain et *al.* (2014) in the Narmada River.

Regarding annual variation it was evident that higher concentration of cadmium, lead and chromium was noticed at A5. Higher concentration of copper and zinc was noticed at A1and A5. Higher concentration of Lead and Chromium was noticed at A5. The reason may be due to the fertilizers and pesticide effluents from the agricultural areas.

Table 1: Physico-chemical properties of Narmada River for Pre-Monsoon

S. No.	Parameters	A1	A2	A3	A4	A5
1	Atmo. Tem. (^{0}C)	30	32	29	29	30
2	Water Tem. (^{0}C)	28	29	26	28	29
3	pH	7.2	7.5	8.2	7.8	8.9
4	DO (mg/l)	4.9	4.5	4.4	5.1	4.9
5	Nitrite(mg/l)	0.059	0.064	0.068	0.072	0.078
6	Nitrate(mg/l)	0.288	0.285	0.324	0.363	0.382
7	Phosphate(mg/l)	0.19	0.18	0.23	0.21	0.26
8	Turbidity (NTU)	14.2	12.17	18.4	23.6	21.3
9	Cadmium (mg/l)	0.006	0.005	0.012	0.018	0.021
10	Copper (mg/l)	0.069	0.026	0.030	0.023	0.032
11	Lead (mg/l)	0.023	0.013	0.007	0.010	0.024
12	Zinc (mg/l)	0.504	0.408	0.496	0.412	0.526
13	Chromium (mg/l)	0.096	0.034	0.076	0.069	0.112

Table 1: Physico-chemical properties of Narmada River for Post-Monsoon

S. No.	Parameters	A1	A2	A3	A4	A5
1	Atmos. Tem. (^{0}C)	27	26	24	25	26
2	Water Tem. (^{0}C)	27	26	24	26	27
3	pH	7.6	7.7	7.9	8.6	9.2
4	DO (mg/l)	5.3	4.7	4.9	5.4	5.6
5	Nitrite(mg/l)	0.069	0.068	0.072	0.076	0.081
6	Nitrate(mg/l)	0.346	0.362	0.389	0.465	0.516
7	Phosphate(mg/l)	0.29	0.22	0.31	0.28	0.34
8	Turbidity (NTU)	26.8	22.7	27.4	30.64	29.1
9	Cadmium (mg/l)	0.019	0.008	0.019	0.024	0.032
10	Copper (mg/l)	0.078	0.006	0.042	0.039	0.049
11	Lead (mg/l)	0.027	0.022	0.017	0.020	0.036
12	Zinc (mg/l)	0.602	0.612	0.552	0.548	0.656
13	Chromium (mg/l)	0.104	0.087	0.099	0.084	0.126

(A1. Confluence point of Chitarewa River mixing with Shakkar River, **A2.**Kakara Ghat of Narmada River, **A3.**Kakara Ghat of Narmada River (2 Km towards upstream region), **A4.**Kakara Ghat of Narmada River (2 km towards downstream region) and **A5.**Confluence point of Shakkar River with Narmada River))

Fig-1. Map showing the Sampling locations in the study area.

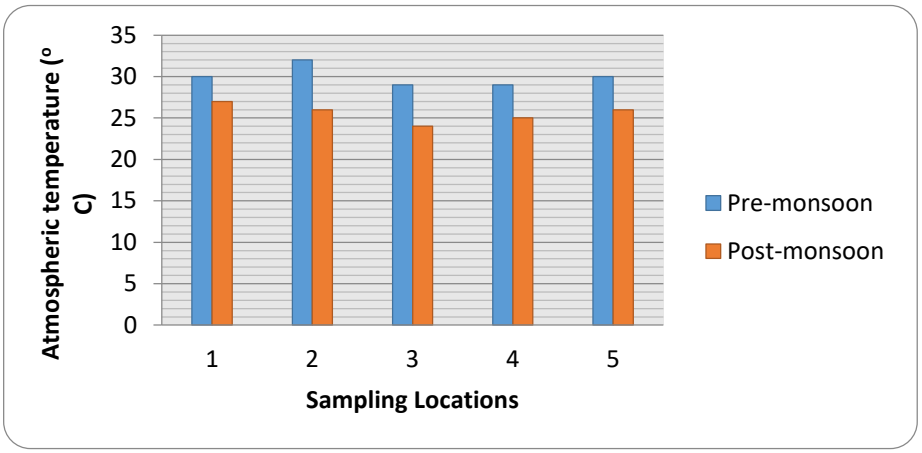

Fig.2. Atmospheric temperature recorded in the present study

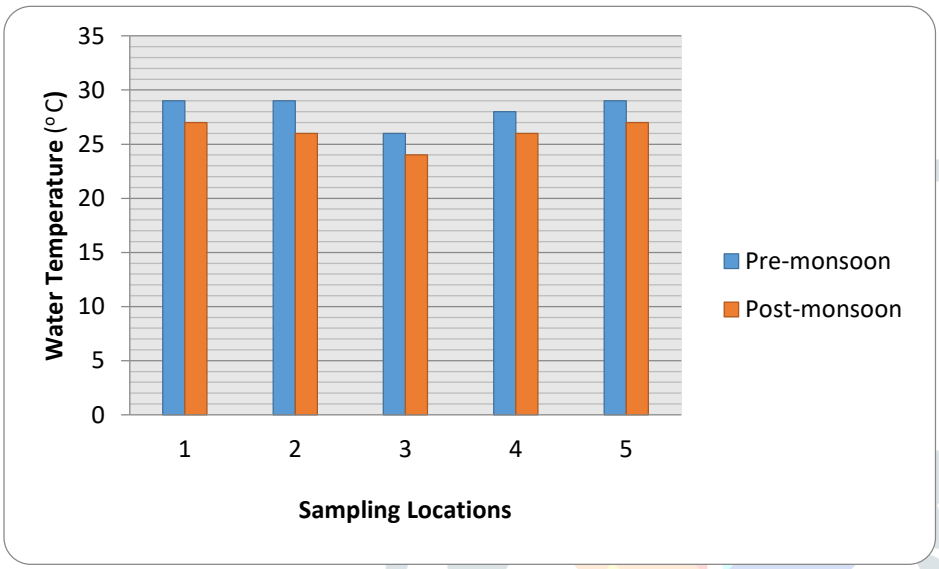

Fig-3. Water temperature recorded in the present study

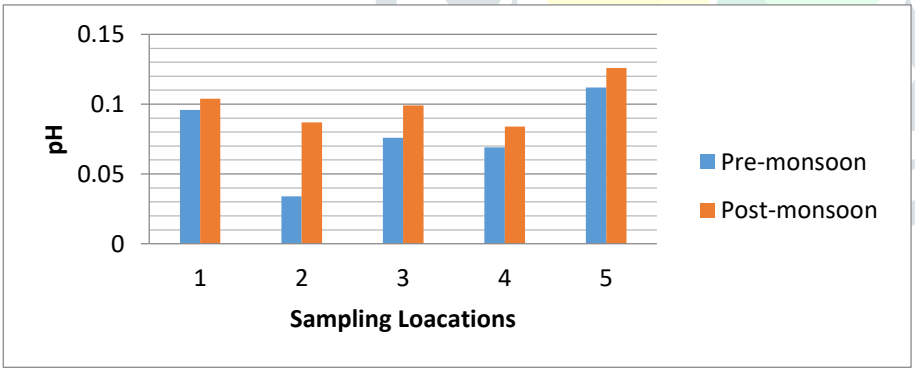

Fig-4. Water pH recorded in the present study

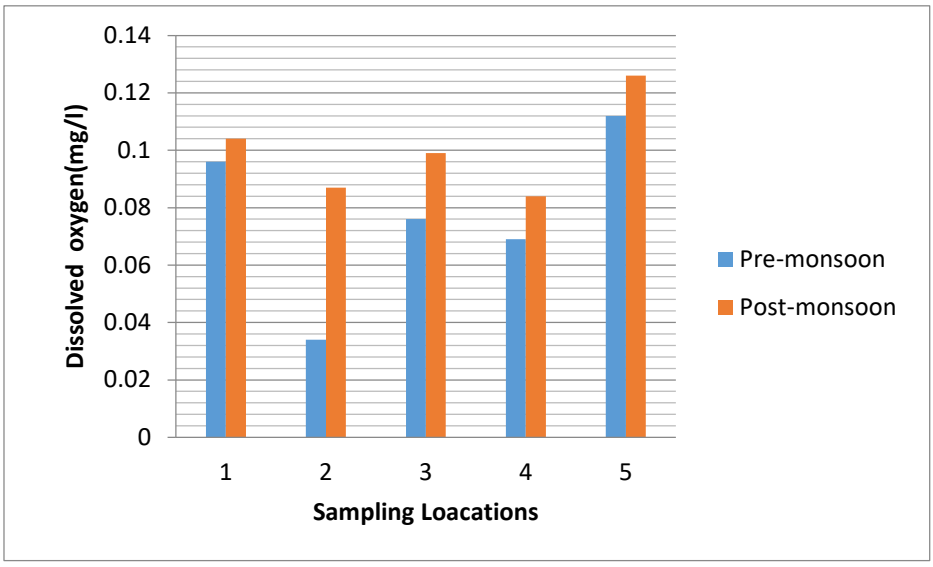

Fig-5. Water DO recorded in the present study

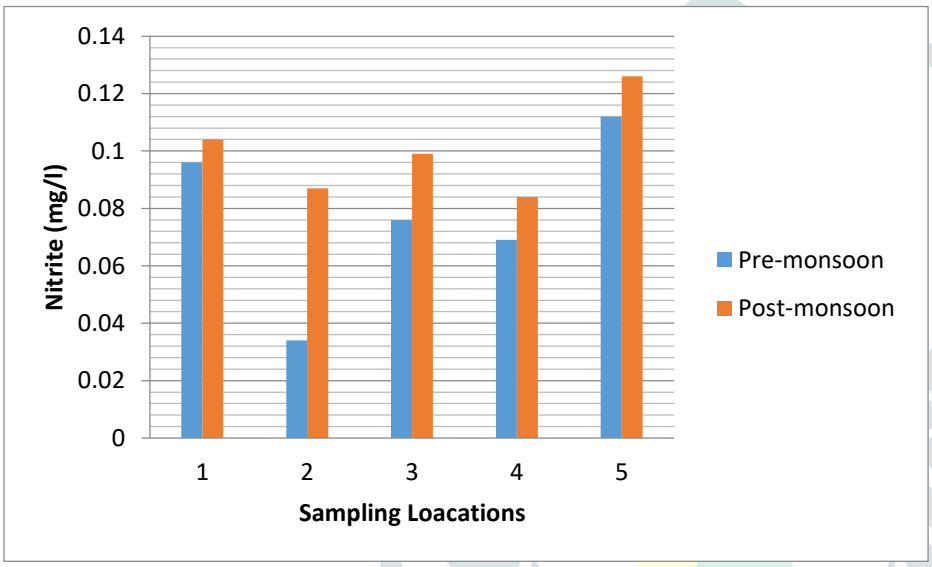

Fig-6. Water nitrite recorded in the present study

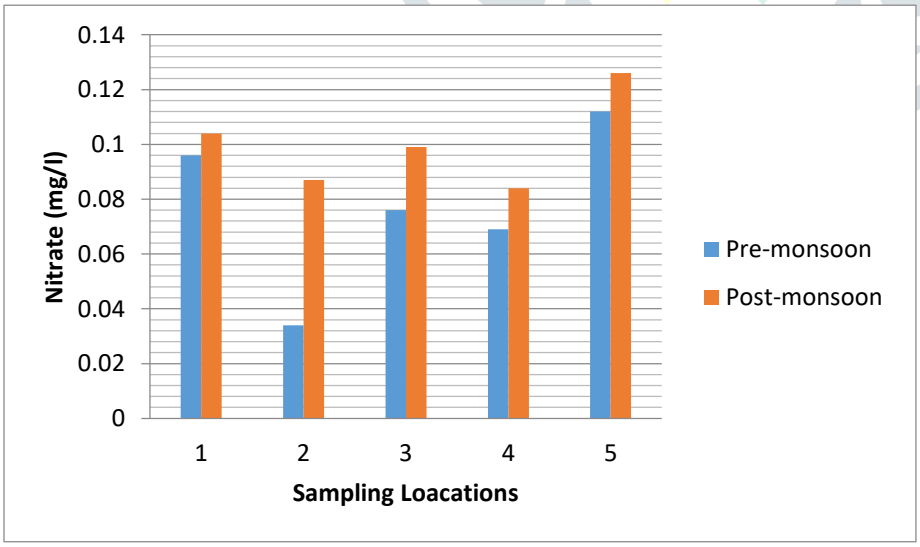

Fig-7. Water Nitrate recoded in the present study

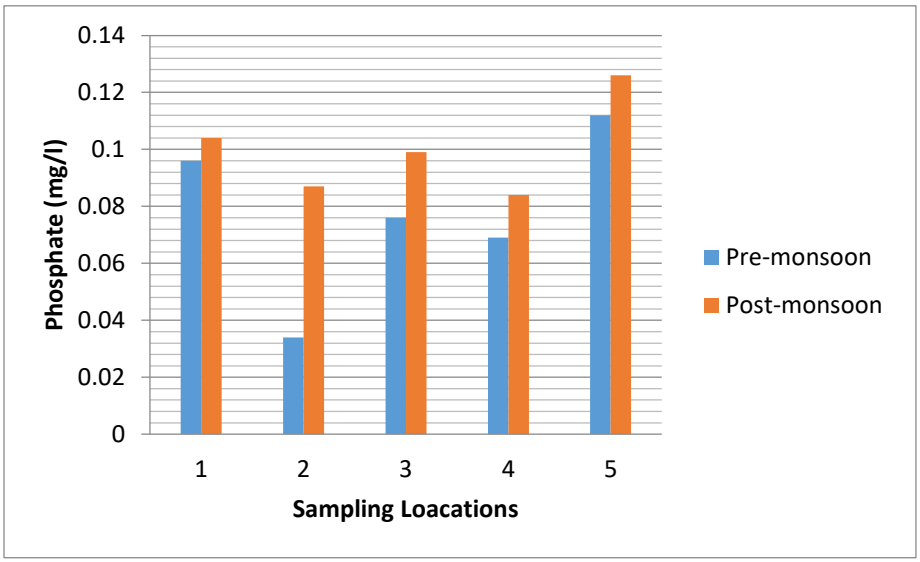

Fig-8. Water Phosphate recorded in the present study

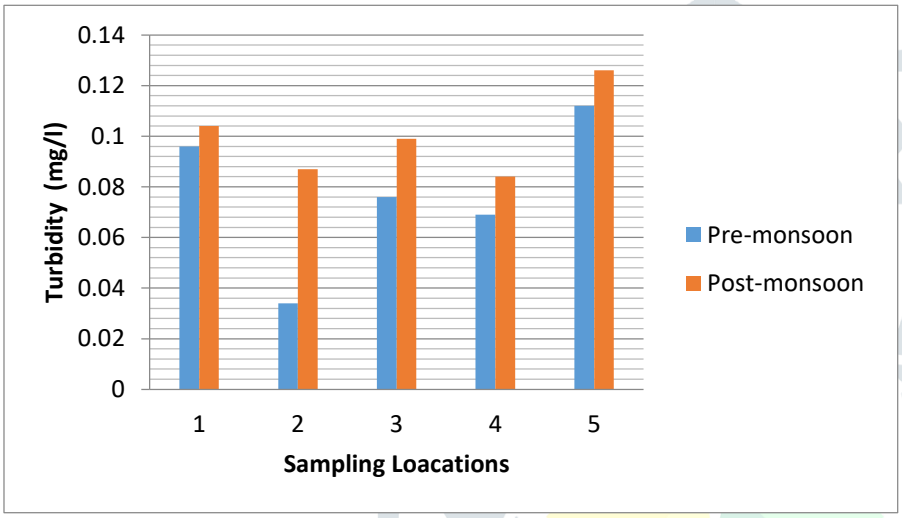

Fig-9. Turbidity value of Narmada River Water

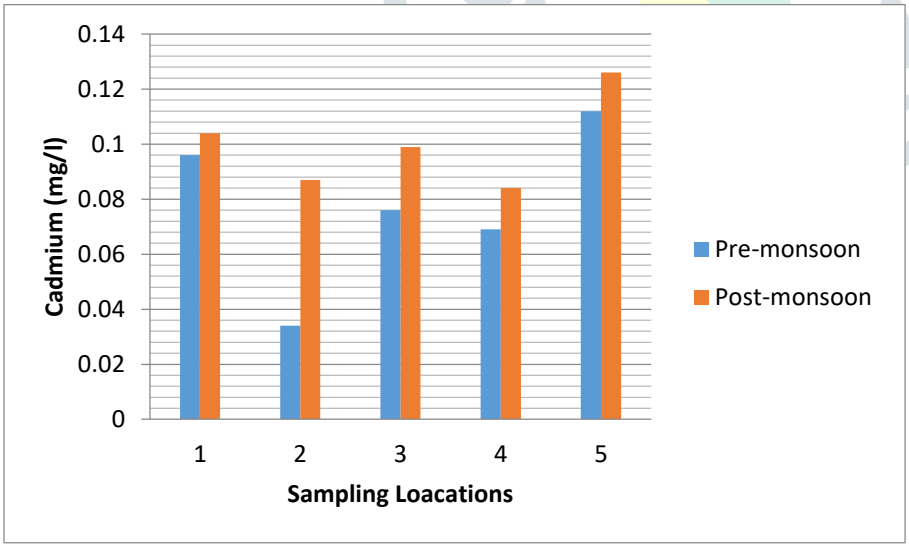

Fig-10. Graph showing variations in Cadmium (mg/l) concentrations at sampling locations

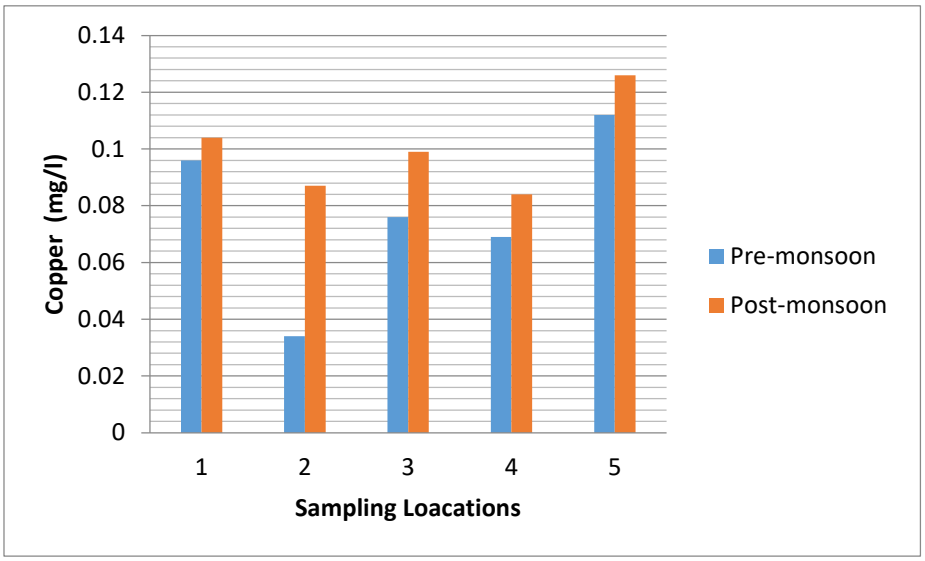

Fig-11. Graph showing variations in Copper (mg/l) concentrations at sampling locations

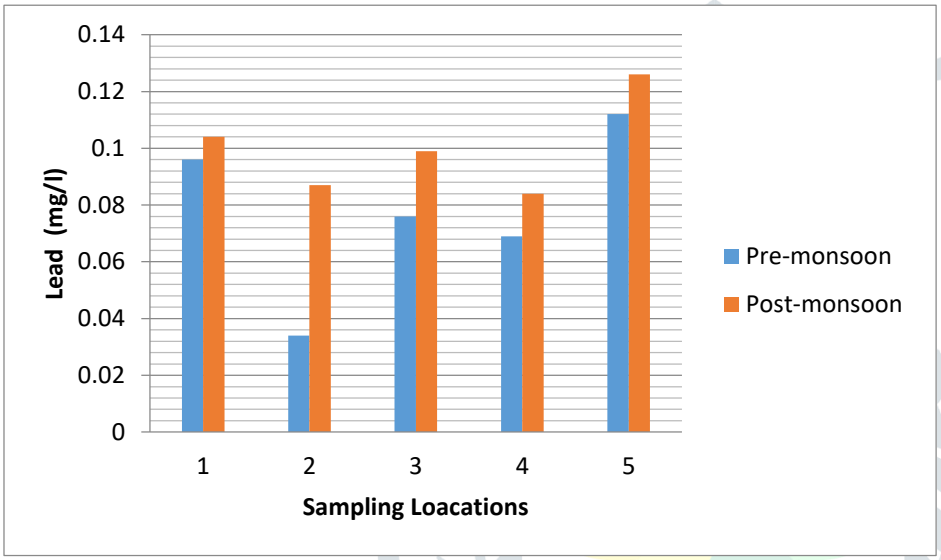

Fig-12. Graph showing variations in Lead (mg/l) concentrations at sampling locations

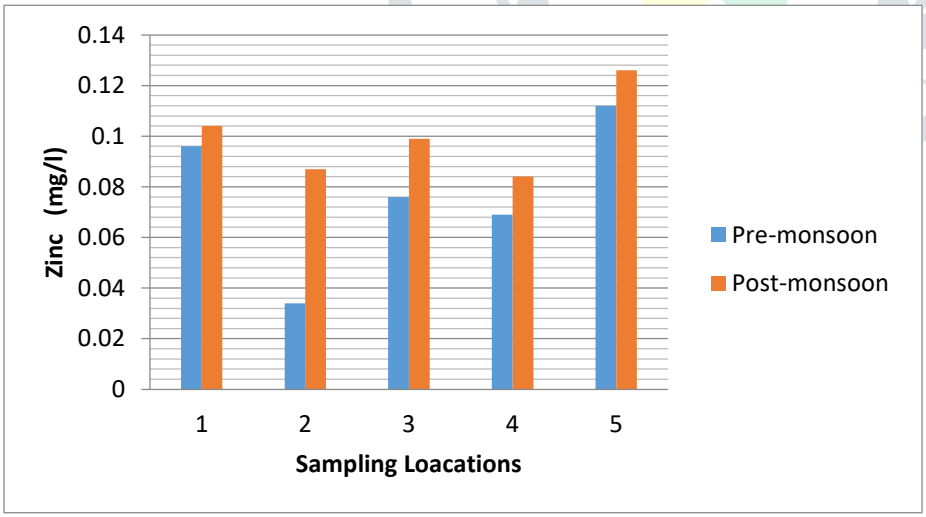

Fig-13..Graph showing variations in Zinc(mg/l) concentrations at sampling locations

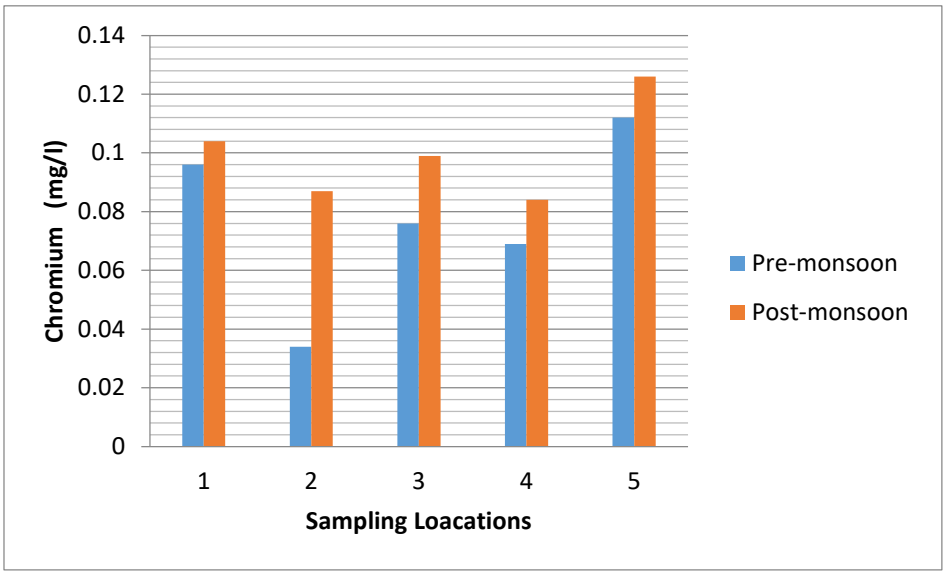

Fig-14. Graph showing variations in Chromium (mg/l) concentrations at sampling locations

4.CONCLUSION

In the present study many physicochemical parameters and its characteristic behavior of a river water samples in different seasons and different sampling stations, the water quality of river is deteriorated due to domestic, industrial effluents direct discharge in to river and various human activities along the banks of the river. 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 all purpose.

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