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Research Article

EVALUATION OF WATER QUALITY: PHYSICO-CHEMICAL PARAMETERS AT DHAMOLA RIVER FROM DIFFERENT SOURCES OF SAHARANPUR CITY

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ABSTRACT
The Dhamola river pollution is going on increasing day to day. The main source of pollution in river include municipal wastes from Saharanpur urban areas and industrial effluents of sugar, pulp and paper, distilleries and other miscellaneous industries through tributaries as well as direct inputs. The main goal of present study was to assess the impact of urban and industrial activities on the water quality of river Dhamola in Saharanpur and to study physico-chemical analysis of water. The laboratory test of the collected water samples were performed for analysis of various physical and chemical parameters such as pH, Temperature, Turbidity, Color, Total Dissolved Solids (TDS), Total Hardness (TH), Calcium Hardness and Alkalinity. The results obtained from chemical analysis were compared with four standards namely ISI, ICMR, BIS and WHO. It is found that this water body is not suitable for drinking and irrigation purpose, so possible remedial methods should be adopted for this water resource for improving its quality.

Keywords: *Physico-Chemical Analysis, Dhamola River, Total Hardness, pH, Alkalinity, Human Impact*

INTRODUCTION
Dhamola River is one of the famous river of Saharanpur (U.P). The human activities like open domestic sewage, agriculture run-off, sewage coming through sewerage pipes, untreated or inadequately treated effluent discharged from several types of industrial units change the chemical, physical, biological and radiological quality of water which make the water of Dhamola River polluted. The Dhamola River pollution is increasing day by day. The pollutant may turn the water unfit for drinking, agriculture, industrial and fishery purposes. The implications of such massive pollution for the health of the nation are extremely serious. On the other hand, Nutrients generated from natural processes are not considered as Pollutants. According to National Research Council the concerns over water quality relate not just to water itself, but also to the danger of diffusion of toxic substances into other eco system. The aquatic environment for living organisms can be affected & bio-accumulation of harmful substances in water-dependent food chain can occur. After reviewing the current literature, it is clear that no comprehensive report is available on the water quality of river Dhamola at Saharanpur. The main objectives of the study were to assess the river water quality. The physico-chemical properties measured here are pH, Temperature, Turbidity, Color, Total Dissolved Solids (TDS), Total Hardness (TH), Calcium Hardness and Alkalinity. Saharanpur city is so poor that water from the surrounding rivers can no longer be considered as a source of water supply for human consumptions (Agarwal *et al.,* 2011, Kumar *et al.,* 2004, APHA 1989, ISI 1983, WHO 1984, Malik, 2015). Temperature, pH, turbidity, conductivity, total suspended solid (TSS), nitrates, total nitrogen & total phosphate are the most important physico-chemical properties of water (APHA, 1992). The assimilation of waste water treatment mechanism is essential to have a sustainable environment (Shivaraju, 2011).

MATERIALS AND METHODS
Methodology
Sampling Area
In the present study, water samples were collected from seven different locations of Dhamola river of Saharanpur in U.P. State. India, Water samples were collected from sampling sites immediately after

heavy rain and approximately after one month of monsoon season. The pH and turbidity were measured and estimated at sampling sites by using water analysis kit (systolic).The other parameters were measured by the procedure given by APHA (1998) in the laboratory. Turbidity Units (NTU) and pH should be less than 8 for effective disinfection (WHO, 2004).

Sampling Methodology

From each sampling location, samples were collected immediately after heavy rain and approximately after one month of monsoon season as recommended in WHO guidelines (WHO 2004, 2009). For statistical significance of the test results, each sampling location was sampled three times during the monsoon and three times after the monsoon on the dates as shown in Table 1. On a specific date, samples from all the seven sampling locations were collected. In this way a total of 42 samples were collected and tested during this study.

For physico-chemical analysis, water samples were collected in a one liter polyethylene (PET) bottle 15-20 cm below the water surface which was filled to the top to exclude air, analyzed within 24 hours and stored at 1- 4^0 C temperature. Care must be taken not to catch any floating material or bed material into the container.

The samples were collected as per the schedule given in the table:

Table 1: Sampling Schedule

	During Monsoon (Heavy Rain)			After Monsoon		
Sample No.	1	2	3	1	2	3
Sampling Date	08.08.2015	10.08.2015	12.08.2015	10.09.2015	15.09.2015	20.09.2015

Determination of Water Quality Parameters

The analysis of various physico-chemical parameters namely pH, Temperature, Turbidity, Color, Total Dissolved Solids (TDS), Total Hardness (TH), Calcium Hardness and Alkalinity were carried out as per the method described in (APHA 1998). The instruments used were in the limit of précised accuracy. The chemicals used were of AR grade. Utmost care was taken during sampling to avoid any kind of contamination. Temperature and pH were measured at the time of sampling itself.

Table 2: Analysis of Various Physico-Chemical Parameters at Seven Sites

Parameters		**S-I**	**S-II**	**S-III**	**S-IV**	**S-V**	**S-VI**	**S-VII**
pH	During Monsoon	6.7	6.5	7.4	7.6	7.2	7.8	7.5
	After Monsoon	8.5	8.3	8.9	9.2	8.8	9.1	8.7
Temperature	During Monsoon	21.7	19.0	28.6	27.4	28.5	30.0	29.3
(^{0}C)	After Monsoon	27.6	26.9	28.5	27.9	29.5	26.9	28.4
Turbidity	During Monsoon	2.5	2.7	3.3	3.8	4.1	3.6	3.0
(NTU)	After Monsoon	5.1	5.4	5.7	5.9	5.2	5.6	5.3
Color	During Monsoon	Clear	Clear	Clear	Clear	Clear	Clear	Clear
	After Monsoon	Black	Black	Black	Black	Black	Black	Black
TDS	During Monsoon	250	256	290	387	455	390	377
(mg/L)	After Monsoon	621	632	624	632	645	612	603
Calcium	During Monsoon	51	53	62	58	55	61	60
Hardness								
(mg/L)	After Monsoon	96	89	94	96	99	101	97
Total Hardness	During Monsoon	150	157	176	164	161	167	166
(mg/L)	After Monsoon	463	468	460	472	456	470	456
Alkalinity	During Monsoon	167	170	174	181	179	178	173
(mg/L)	After Monsoon	248	242	249	243	250	252	248

RESULTS AND DISCUSSION

***1- pH*:** The mean values of pH at seven sampling points immediately after heavy rain and approximately after one month of monsoon season are shown in Figure1. The pH values immediately after heavy rain at all the sources are well within the ISI, ICMR, BIS and WHO desirable limits and pH values after one month of monsoon season are greater than 8.5 at all sampling sites. WHO proposed a desirable range of 6.5 to 8.5 for pH of drinking water (BIS, 1991, 2004, 2005).

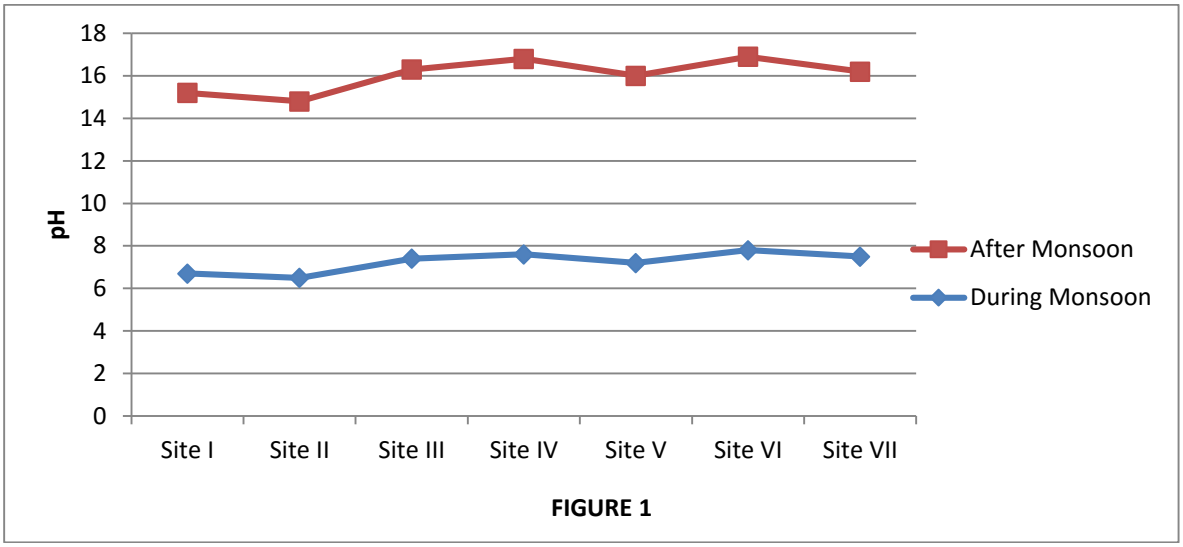


FIGURE 1

2-Temperature: The mean values of temperature at seven sampling points immediately after heavy rain and approximately after one month of monsoon season are shown in Figure 2. No health based guidelines are proposed for temperature by ISI, ICMR, BIS and WHO. The temperature of the collected water samples varies in between 19 ^{0}C to 30 ^{0}C at all sampling sites after heavy rain and approximately after one month of monsoon season.

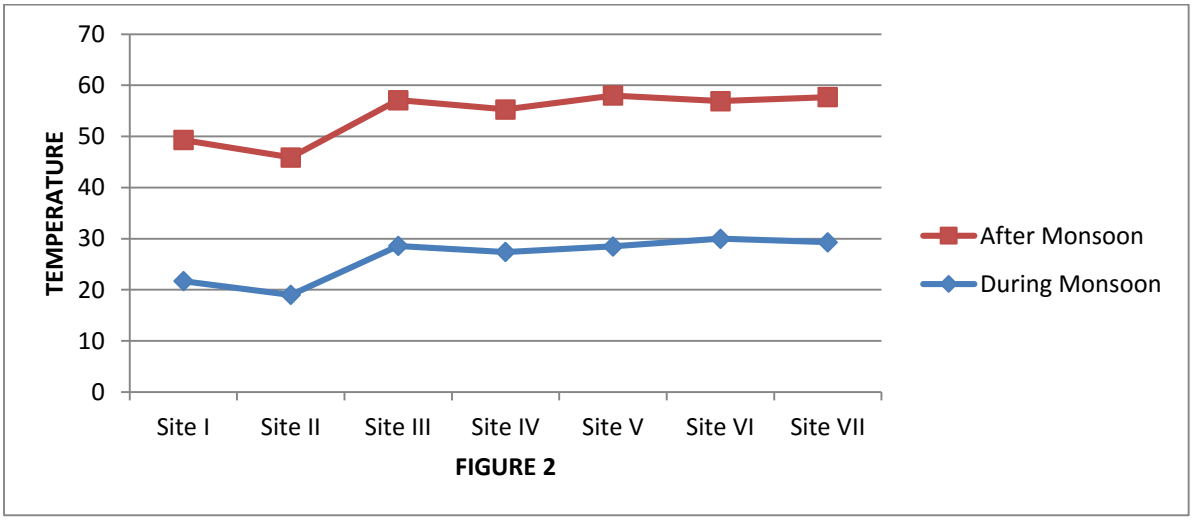


FIGURE 2

3-Turbidity: The mean values of turbidity at seven sampling points immediately after heavy rain and approximately after one month of monsoon season are shown in Figure 3. It is evident from Figure 3 that at all the sources, the turbidity in water is in the desirable limit immediately after heavy rain. It rose above 5.0 NTU after one month of monsoon season at all sampling sites.

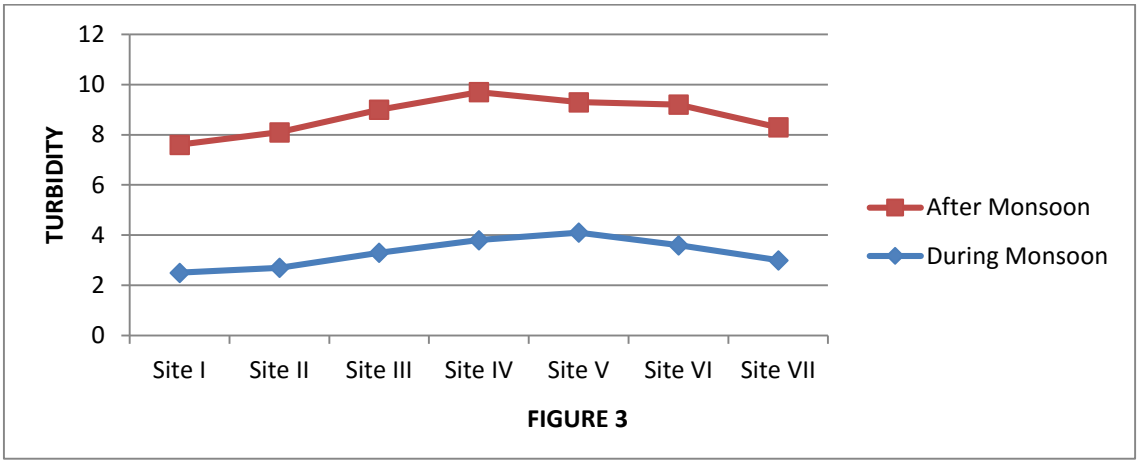
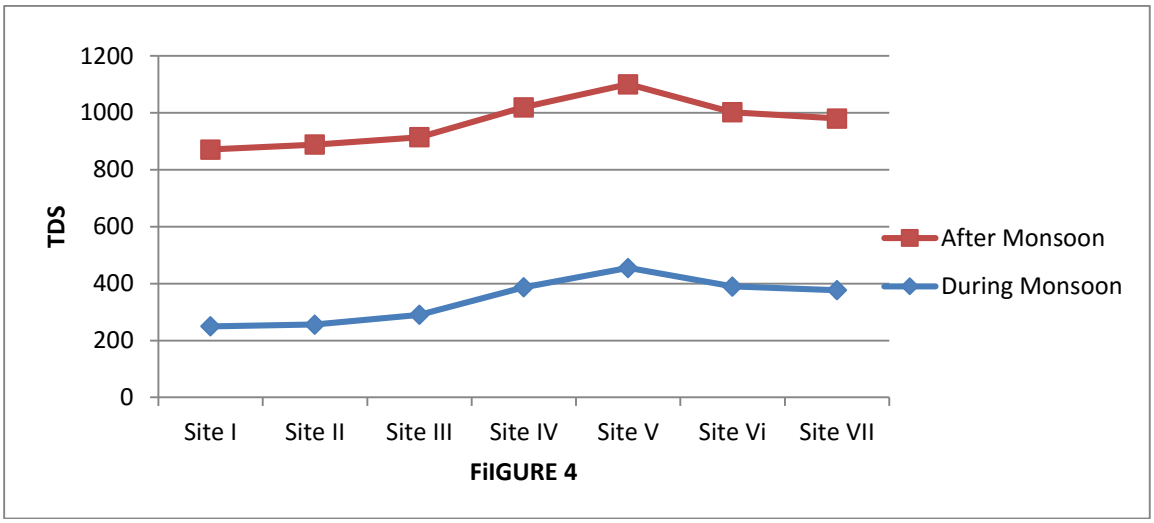


FIGURE 3

4-Color: The water samples are generally colored due to the presence of colloidal substance, inorganic impurity, aquatic growth, and decomposition of vegetation. The water sample collected was found to be odorless, colorless and clear immediately after heavy rain. It becomes blackish after one month of monsoon season at all sampling sites.

5-Total Dissolved Solid: The TDS values immediately after heavy rain at all the sources are well within the ISI, ICMR, BIS and WHO desirable limits of 250-455 mg/L and TDS values after one month of monsoon season are greater than 600 mg/L at all sampling sites. The quantity of TDS was proportional to the degree of pollution (Rain *et al.*,1990, Nasrullah, 2006).



FiIGURE 4

6-Calcium Hardness: The mean values of calcium hardness at seven sampling points immediately after heavy rain and approximately after one month of monsoon season are shown in Figure 4. The calcium hardness values immediately after heavy rain at all the sources are well within the ISI, ICMR, BIS and WHO desirable limits and calcium hardness after one month of monsoon season are greater than 90 mg/L at all sampling sites.

7- Total Hardness: The mean values of total hardness at seven sampling points immediately after heavy rain and approximately after one month of monsoon season are shown in Figure 5. The Total Hardness values immediately after heavy rain at all the sources are well within the ISI, ICMR, BIS and WHO desirable limits and total hardness values after one month of monsoon season are greater than 455 mg/L at all sampling sites. The total hardness is mainly due to Ca, Mg and Eutrophication (Sharma, 2001 and De, 1994).

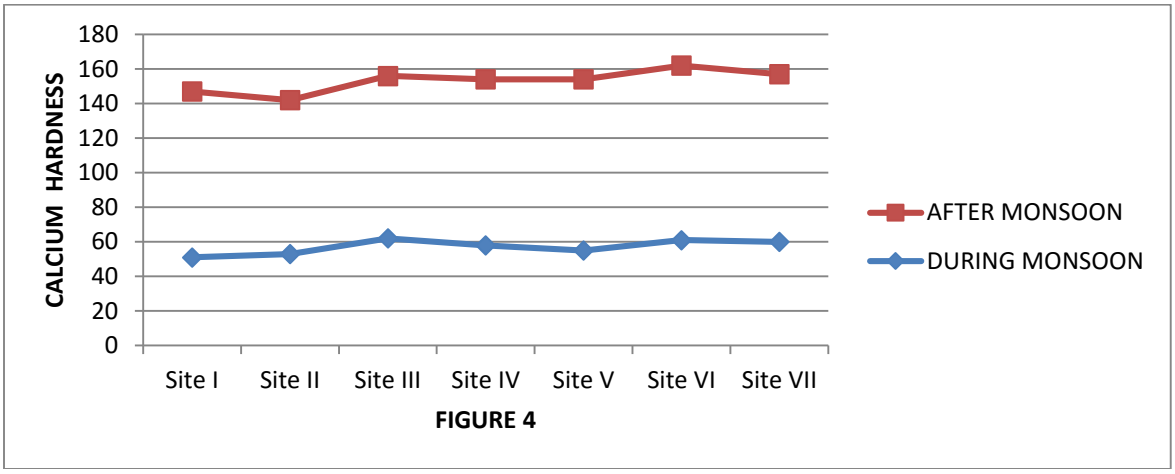


FIGURE 4

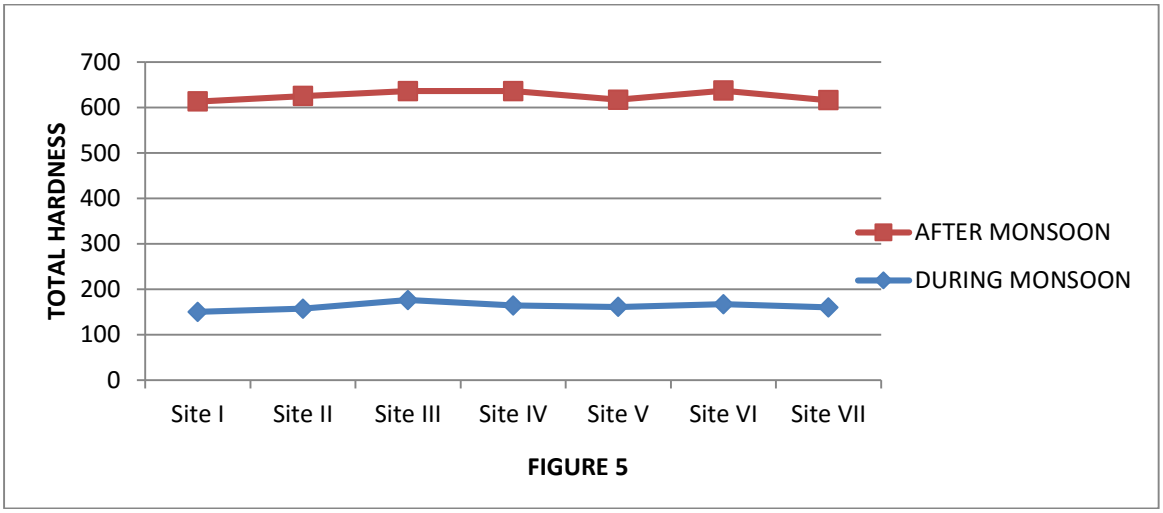


FIGURE 5

8- Alkalinity: The mean values of Alkalinity at seven sampling points immediately after heavy rain and approximately after one month of monsoon season are shown in Figure 6. The Alkalinity values immediately after heavy rain at all the sources are well within the ISI, ICMR, BIS and WHO desirable limits and alkalinity values after one month of monsoon season are greater than 240 mg/L at all sampling sites.

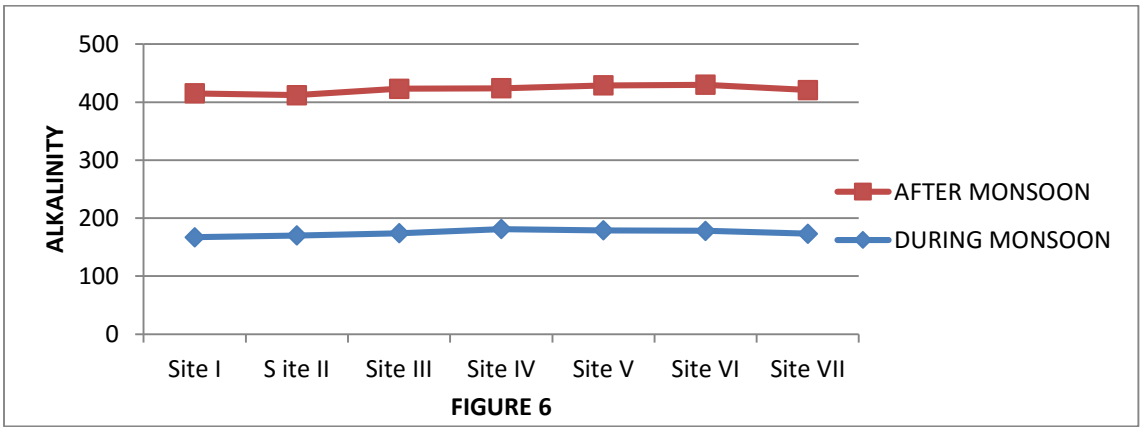


FIGURE 6

Conclusion

The physicochemical parameters (pH, Temperature, Turbidity, Color, Total Dissolved Solids (TDS), Total Hardness (TH), Calcium Hardness and Alkalinity) at all the sampling sites in the study area were within the limits after heavy rain and after one month of monsoon season are greater than desirable limits at all sampling sites. It can, therefore, be concluded that it is not suitable for drinking and irrigation purpose, so possible remedial methods should be adopted for this water resource for improving its quality. It is very much necessary to conduct more research on this river and has to make awareness among the people about the pollution problem. Few recommendations to improve the water quality are as follows:

1- In order to address the non point source pollution of water, many agencies have come up with various proposals & some programs are being effectively organized targeting various programs, funds, training, technical assistance, incentives and other management tools. The assimilation of waste water treatment mechanism is essential to have a sustainable environment.

2- Pounding of wastewater in the streets be avoided through effective wastewater collection system.

3- Sewer lines are laid on the opposite sides of the river to avoid pollution.

4- Water must not be used for drinking and irrigation purposes without proper treatment.

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