Evolution of Physico- Chemical Parameter of River Narmada, M.P. India

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Abstract
The Narmada is also called Rewa, is the fifth largest river in India. The bank of Narmada is cover by tribal people. Narmada is Holy River. In the present study Eleven sampling station selected at different location in Narmada viz, Punasa, Omkareshwar, Barwah, jalud, Mandleshwar, Maheshwar, Khalghat, Dharampuri, Barwani, Koteshwar, Kakrana. Kakrana is also last point of River Narmada in M.P. Water sample were collected from selected sampling station in September 2016. In physico- chemical analysis such as pH, specific Conductivity, Total Alkalinity, Total Hardness, Ca Hardness, Mg Hardness, Chloride, DO, BOD, COD, Nitrate, Nitrite, Phosphate, Sulphate were analyzed as per standard methods of APHA (2000). The results indicate that the Quality of River Narmada is of class 'A' as per classification criteria of River

Keyword
River Narmada, Punasa, Omkareshwar, Barwah, jalud, Mandleshwar, Maheshwar, Khalghat, Dharampuri, Barwani, Koteshwar, Kakrana, River Water Quality, Physico- chemical parameter.

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Introduction
Water is the most precise thing in this world, which we cannot live without. Water is super abundant on the planet as a whole, but fresh potable water is not always available at the right time or the right place for human or ecosystem use. The water being an important part of environment occurs as solid, liquid and gas forms on the earth. As a liquid, it forms hydrosphere, which covers approximately three-fourth of the earth's surface. About 97% of the total available water on earth is saline, and hardly 3% is fresh. A small portion of this fresh water fulfills the fresh water requirements of human beings[1]. Rivers play a significant role in fulfilling the fresh water requirements in the world. In spite of their wide-ranging role, presently rivers are under severe threat due to various anthropogenic pressure[2]. Humans frequently exert rapid, large scale influence on their immediate environment, including modification of water courses, pollution, hunting and fishing[3]. In the last few decades, there has been a tremendous increase in the demand for freshwater due to rapid growth of population and the accelerated pace of industrialization[4].

With the rapid development in agriculture, mining, urbanization, and industrialization activities, the river water Contamination with hazardous waste and wastewater is becoming a common phenomenon. The water quality and human health are closely related. The domestic waste from each building along with the effluent of small scale industries is disposed off into the open drains and gutters which ultimately enter into the rivers. The quality of water is mainly deteriorated by human activities. They use dispose the waste directly or indirectly into the river water, which affects the B.O.D., C.O.D., Turbidity and also causes the Physico-Chemical changes. Rivers are getting contaminated due to waste disposing into them. Waste comprises liquid waste discharged by domestic residences. Most of the Indian Rivers and their Tributataries viz., Ganges, Yamuna, Godavari, Krishna, Sonw, Cauvery Damodar and Brahmaputra are reported to be grossly polluted due to discharge of untreated sewage disposal and industrial effluents directly into the rivers[5]. The indiscriminate dumping and release of wastes containing the hazardous substances into rivers might lead to environmental disturbance which could be considered as a potential source of stress to biotic community. Similarly many rivers were surveyed during past two decades with respect to their pollution status. In addition to domestic and industrial discharge into the rivers, there were continued surface run off of agriculture areas, mines and even from cremation on the river banks[6]. According to a report, over 32 thousand dead bodies were cremated at the major burning Ghats per year in Varanasi alone in the year 1984[7].

The Narmada, is a river in central India and the fifth largest river in the Indian subcontinent[8]. With the rapid development in agriculture, mining, urbanization, and industrialization activities, the river water contamination with hazardous waste and wastewater[9]. Assessment of water quality can be defined as the analysis of physical, chemical and biological characteristics of water. Water quality indices used for assessing surface water quality. Due to heavy discharge of harmful and deleterious substances in river, the biological, chemical and physical characteristics of water have changed to a considerable extent. The objectives of this study were to find out the changes in Physico-Chemical Nature as well as Biological Health of Narmada River[10].

Materials and Methods

Narmada River is the Fifth Largest River in the Indian Subcontinent. It is the Third Largest River that Completely Flows within India after Ganges and Godavari. The Narmada river basin lies in the central part of India, between 72° 20” E to 81° 45” E longitude and 21° 20” N to 23° 45” N latitude with a drainage area of 98,796 sq. km and a mean elevation of 760 m. Narmada river originates in the Maikal Mountain ranges in Amarkantak in Madhya Pradesh state, and flows through west for a distance of 1312 km into the Gulf of Cambay, west of Bharuch District in Gujarat State (NIH, 1999). The source of the Narmada is a small tank called Narmada Kund located on the Amarkantak Hill 1,057 m (3,467.8 ft), in the Anuppur District of eastern Madhya Pradesh[11].

Water sample were collected in September 2016 from Eleven selected sampling station viz- Indira Sagar Dam (Punasa) (N1), Omkareshwar (N2), Barwah (N3), Jalud (N4), Mandleshwar (N5), Maheshwar (N6), Khalghat (N7), Dhrampuri (N8), Barwani (N9), Koteshwar (N10), kakrana (N11). In the evaluation of physico-chemical parameter of water, standard methods approved in available literature were used. pH, conductivity, Total alkalinity, Total hardness, Calcium Hardness, Magnesium Hardness, Chloride, Dissolve oxygen, B.O.D., C.O.D., Nitrite,

Nitrate, Phosphate and Sulphate were determined in the laboratory. The Physico-Chemical parameters of water were determined as per standard methods of APHA (2002).

pH of water sample measured by pH meter using standard solutions; conductivity measured by conductivity meter; Total Alkalinity and Bicarbonate Determined by Acid-Base Titration Method; Value of Total Hardness, Calcium Hardness and Magnesium Hardness of water sample determined by EDTA method; Chloride determined by Argentometric Method; Nitrate and Nitrite measured by Spectrophotometric method; Dissolved Oxygen Determine by Winkler method; BOD also analyzed using BOD incubator; COD measured using open reflux method.

Results and Discussion

The results of study have been reported in the given table. The values of all the parameter were found to be within the limits. (Table -1)

pH–Potential of hydrogen, is the measure of the concentration of hydrogen ions. It provides the measure of the acidity or alkalinity of a solution. In the present study the observed pH values ranging from 8.16 to 8.36. These values are within maximum permissible limited prescribed by WHO (1993) The minimum value of pH was recorded at N3 sampling station and the maximum pH value was recorded at N9 sampling Station. (Fig-1)

Specific Conductivity- EC measurement is an excellent indicator of TDS, which is a measure of salinity that affects the taste of potable water. The Electrical Conductivity of water sample of Narmada River ranging from 249 µMhos/cm. to 362 µMhos/cm.. The minimum value of Specific Conductivity was recorded at N10 sampling station and the maximum value of specific conductivity was recorded at N6 sampling station. (Fig.-2)

Total alkalinity- Alkalinity of water is a measure of weak acid present in it and of the cations balanced against them (Sverdrap et al 1942). The Concentration of Total alkalinity in Narmada River water sample ranging from 110 mg/1 to 168 mg/l. The minimum value of Total alkalinity was recorded at N4 sampling station and the maximum value was recorded at N9 sampling station. (Fig.- 3)

Total Hardness- Total Hardness is the parameter of water quality used to describe the effect of dissolved minerals (mostly Ca and Mg), determining suitability of water for domestic, industrial and drinking purposes and attributed to presence of bicarbonates, Sulphates, chloride and nitrates of calcium and Magnesium (Taylor 1949). The Concentration of Total Hardness in Narmada River water sample ranging from 96 mg/1 to150 mg/1. The minimum value of Total hardness was recorded at N1 sampling station and the maximum value of Total hardness was recorded at N6 sampling station. (Fig.-4)

Ca Hardness- The concentration of Ca Hardness in Narmada river water sample ranging from 76 mg/1 to120 mg/1. The minimum value of Ca Hardness was recorded at N3 sampling station and the maximum value of Ca Hardness was recorded at N6 sampling station. (Fig.- 5)

Mg Hardness- Magnesium as co factor for various enzymatic transformations within the cell especially in the trans-phosphorylation in algal, fungal and bacterial cell. The concentration of

Mg Hardness in Narmada River water sample ranging from 16 mg/1 to 34 mg/1. The minimum value of Mg Hardness was recorded at N3, N4 sampling station and the maximum value of Mg Hardness was recorded at N9 sampling station. (Fig.-6)

Chloride

Chloride is one of the major inorganic anion in water and waste water. The concentration of Chloride in Narmada River water sample ranging from 19.56 mg/l to 29.99mg/l. The minimum value of Chloride was recorded at N4 sampling station and the Maximum value of Chloride was recorded at N11 sampling station. (Fig.-7)

Dissolved oxygen - Dissolved oxygen in natural and waste water depends on the Physical, Chemical and Biological activities in the water body. In the present study DO ranging from 6.8 mg/1 to7.8 mg/1. The minimum value of Dissolved oxygen was recorded at N1 sampling station and the maximum value of Dissolved oxygen recorded at N4 sampling station. (Fig. 8).

Biochemical Oxygen Demand - The Biochemical Oxygen Demand, abbreviated as BOD, is a test for measuring the amount of biodegradable organic material present in a sample of water. In the present study the BOD was ranging from 1 mg/l to 1.2 mg/l . The minimum value of BOD was recorded at N1,N4, N8 sampling station and the Maximum value of BOD was recorded at N2, N5, N6, N9, N10, N11 sampling station. (Fig. 9)

Chemical oxygen demand- Chemical Oxygen Demand determines the Oxygen required for chemical oxidation of organic matter. COD values convey the amount of dissolved oxidisable organic matter including the non-biodegradable matters present in it. In the present study the COD was ranging from 8 mg/l to 14 mg/l. The minimum value of COD was recorded at N4 sampling station, and the Maximum value of COD was recorded at N6 sampling station.(Fig. 10)

Nitrite- In general, increase downstream the pollution input gives a sufficient indication of the deteriorating quality of water due to entry of wastewater in river. In the present study the concentration of Nitrite was ranging from 0.603 mg/1 to 1.303 mg/1. The minimum value of Nitrite was recorded at N3 sampling station and the maximum value of Nitrite was recorded at N6 sampling station. (Fig.-11)

Nitrate- Nitrates are the most oxidized forms of nitrogen and the end product of the aerobic decomposition of organic nitrogenous matter. Nitrogen is an essential building block in the synthesis of protein. The evaluation of nitrogen is therefore an important parameter in understanding the nutritional status of water bodies. In the present study the concentration of nitrate was ranging from 0.002 mg/1 to 0.025 mg/1. The minimum value of Nitrate was recorded at N1,N8 sampling station and the maximum value of Nitrate was recorded at N6 station sampling station. (Fig.-12)

Phosphate - The increased application of fertilizers, use of detergents and domestic sewage greatly contribute to the heavy loading of phosphorous in the water. In the present study the concentration of Phosphate was ranging from 0.007 mg/1 to 0.032 mg/1. The minimum value of Phosphate was recorded at N10 sampling station and the maximum value of Phosphate was recorded at N6 sampling station. (Fig.- 13)

Sulphate- Sulphate is widely distributed in nature and may be present in natural waters. The main source of sulphur is the rocks present near the water bodies and biochemical action of anaerobic bacteria. In the present study the concentration of Sulphate was ranging from 2.16 mg/1 to 6.24 mg/1. The minimum value of sulphate was recorded at N3 sampling station and the maximum value of sulphate was recorded at N6 sampling station. (Fig.- 14)

Table 1
Water quality parameter of Narmada River Sample from study area

S.No.	Characteristic	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**	**N9**	**N10**	**N11**
1.	pH	8.2	8.2	8.16	8.24	8.3	8.29	8.3	8.2	8.36	8.24	8.32
2.	Sp. Conductivity (µMhos/cm)	260	263	267	320	336	362	269	252	310	249	258
3.	Total Alkalinity (mg/1)	124	128	116	110	126	134	124	128	168	124	128
4.	Total Hardness (mg/1)	96	112	108	124	136	150	116	108	146	104	104
5.	Calcium Hardness (mg/1)	80	92	76	108	112	120	92	108	112	84	80
6.	Magnesium Hardness (mg/1)	16	20	32	16	24	30	24	20	34	20	24
7.	Chloride (mg/1)	28.71	22.97	28.71	19.56	21.52	23.48	24.99	19.99	26.8	24.99	29.99
8.	Dissolved Oxygen (mg/1)	6.8	7.2	6.9	7.8	7.7	7.6	7.5	7.4	7.2	7.4	7.2
9.	B.O.D. (mg/1)	1	1.2	1.1	1	1.2	1.2	1.1	1	1.2	1.2	1.2
10.	C.O.D. (mg/1)	9.8	10	10	8	10	14	11.85	10.86	12	13.83	12.84
11.	Nitrite Nitrogen (mg/1)	0.66	0.808	0.603	0.86	0.94	1.303	0.74	0.73	0.82	0.82	0.89
12.	Nitrate Nitrogen (mg/1)	0.002	0.004	0.003	0.004	0.005	0.025	0.004	0.002	0.004	0.003	0.004
13.	Phosphate (PO4) (mg/1)	0.008	0.014	0.014	0.024	0.026	0.032	0.008	0.011	0.016	0.007	0.011
14.	Sulphate (SO4) (mg/1)	2.98	4.02	2.16	4.64	5.2	6.24	3.04	2.83	4.26	2.34	2.98

Conclusion

The present study of Narmada River Water at all selected sampling station- Indira Sagar Dam (Punasa) (N1), Omkareshwar (N2), Barwah (N3), Jalood (N4), Mandleshwar (N5), Maheshwar (N6), Khalghat (N7), Dharampuri (N8), Barwani (N9), Nisarpur (N10), Kakrana (N11), was observed that the water of Narmada river at quite within the acceptable range and shows that the overall quality of water is suitable and safe for Drinking Purpose without conventional treatment but after Disinfection, Domestic and Irrigation purposes and One the basis of above study we can say that the quality of River Narmada is of class 'A' as per classification criteria of River.

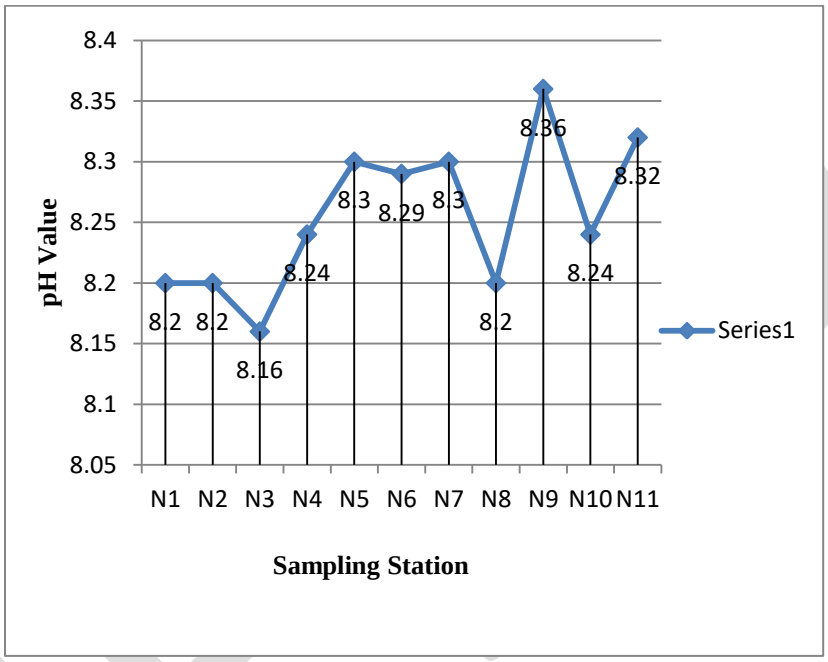

Figure 1- Graph Showing Variation in pH at Different Sampling Station

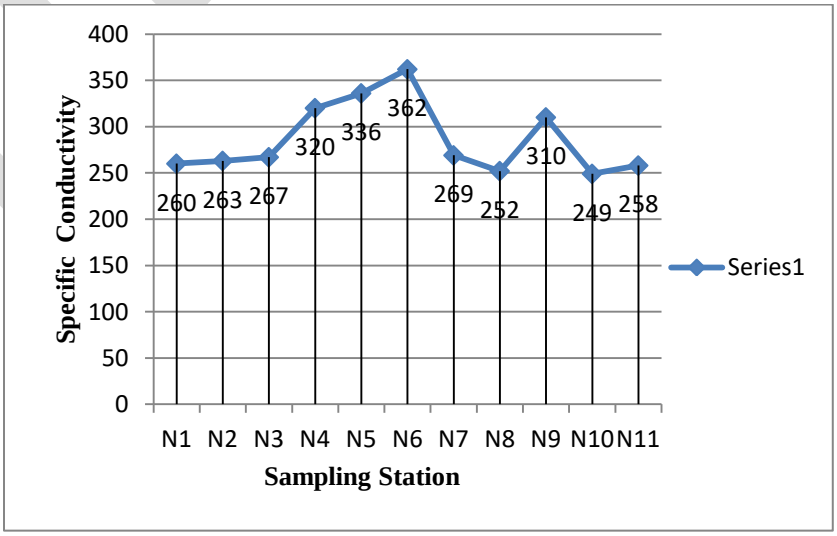

Figure 2- Graph Showing Variation in Specific Conductivity at different Sampling Station

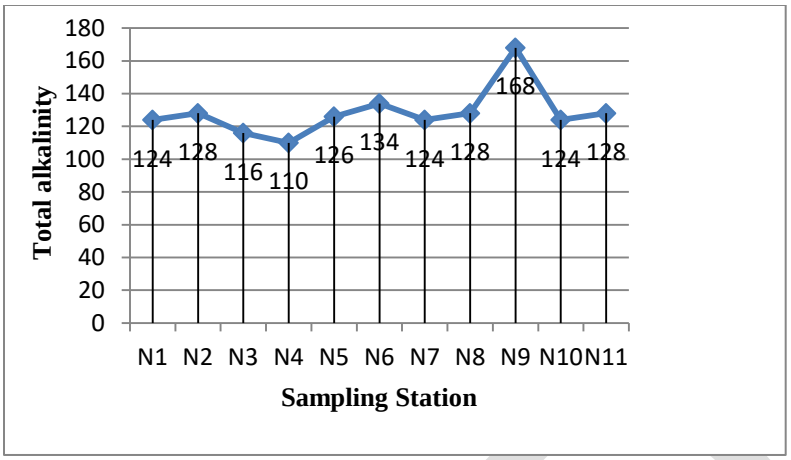

Figure 3- Graph Showing Variation in Total alkalinity at Different Sampling Station

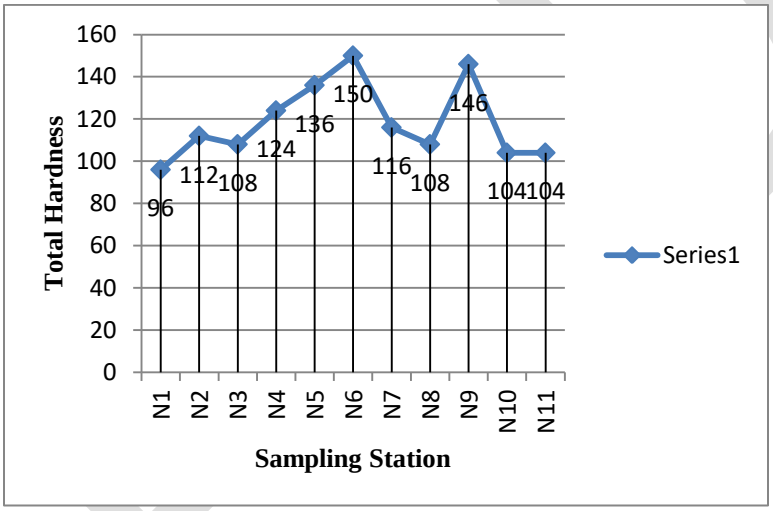

Figure 4- Graph Showing Variation in Total Hardness at Different Sampling Station

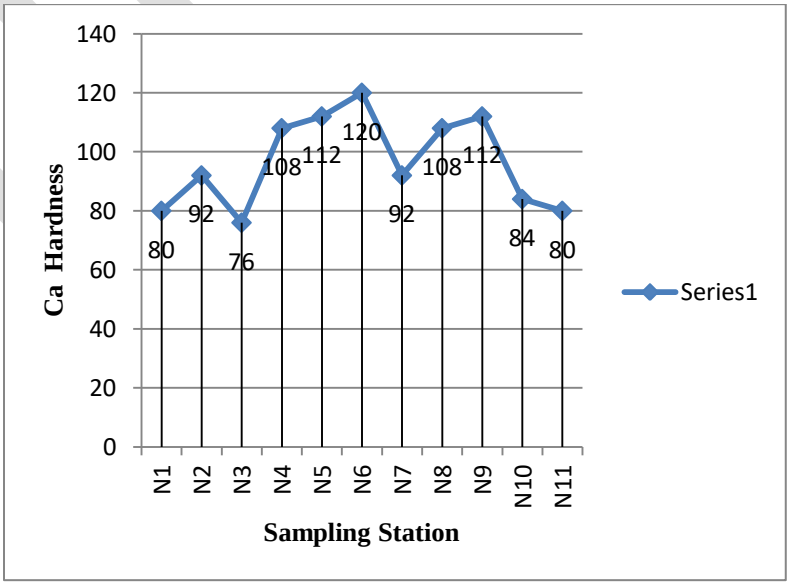

Figure 5- Graph Showing Variation in Ca Hardness at Different Sampling Station

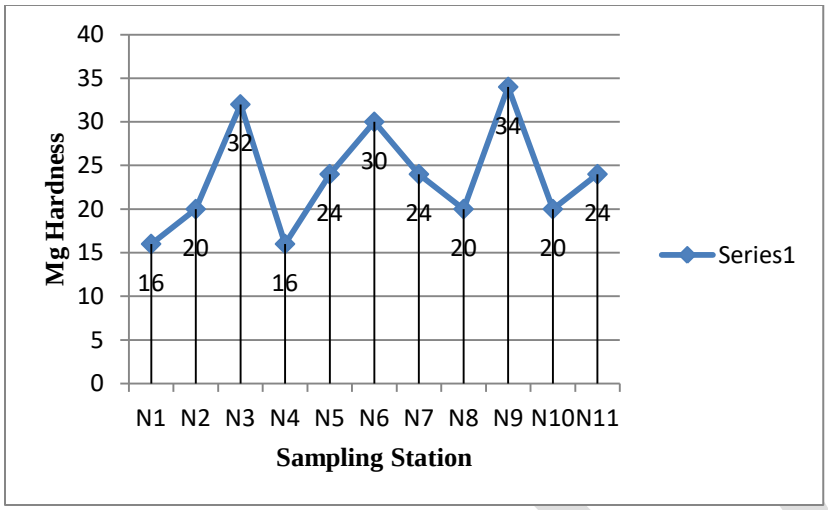

Figure 6- Graph Showing Variation in Mg Hardness at Different Sampling Station

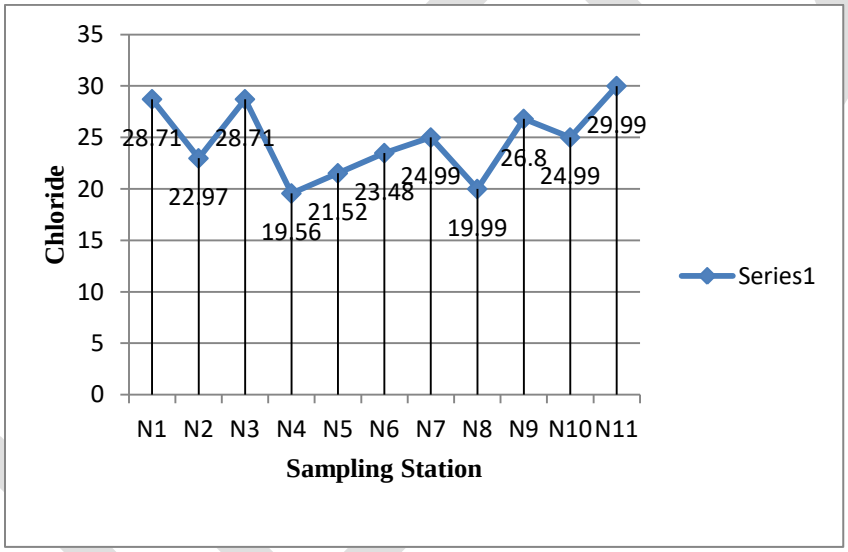

Figure 7- Graph Showing Variation in Chloride at Different Sampling Station

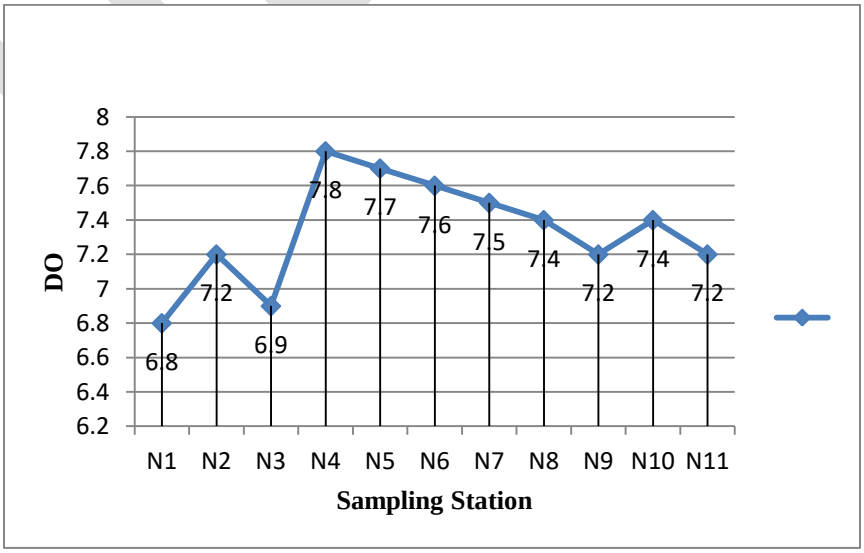

Figure 8- Graph Showing Variation in Do at Different Sampling Station

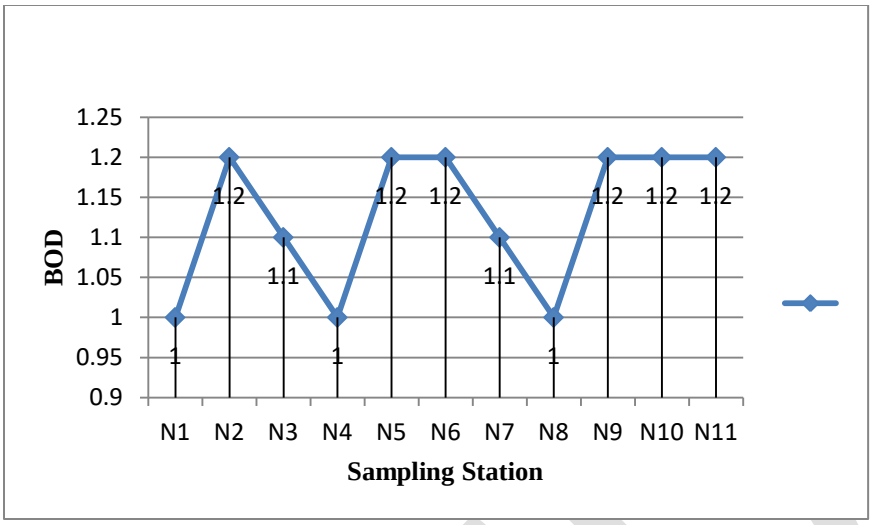

Figure 9- Graph Showing Variation in BOD at Different Sampling Station

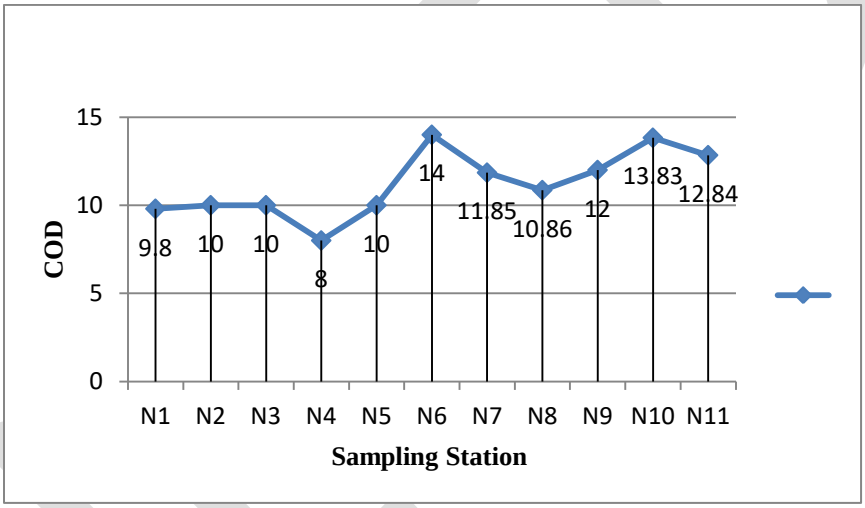

Figure 10- Graph Showing Variation in COD at Different Sampling Station

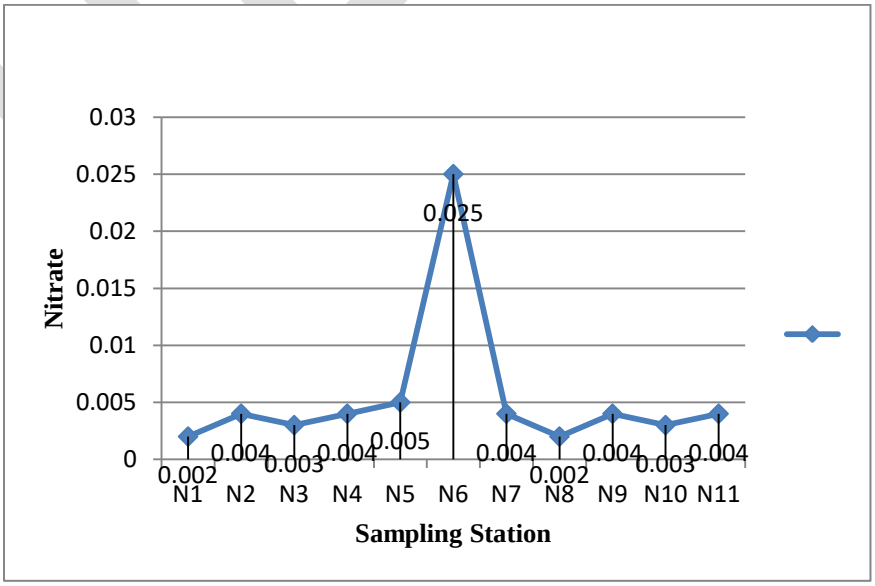

Figure 11- Graph Showing Variation in Nitrate at Different Sampling Station

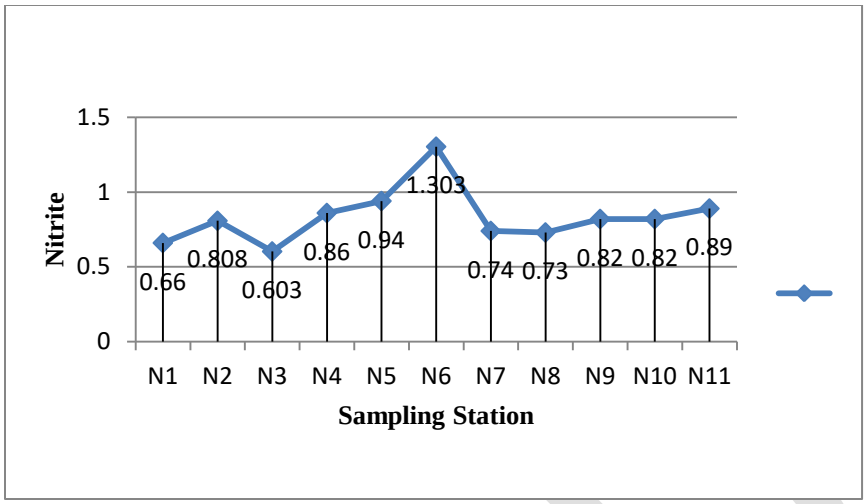

Figure 12- Graph Showing Variation in Nitrite at Different Sampling Station

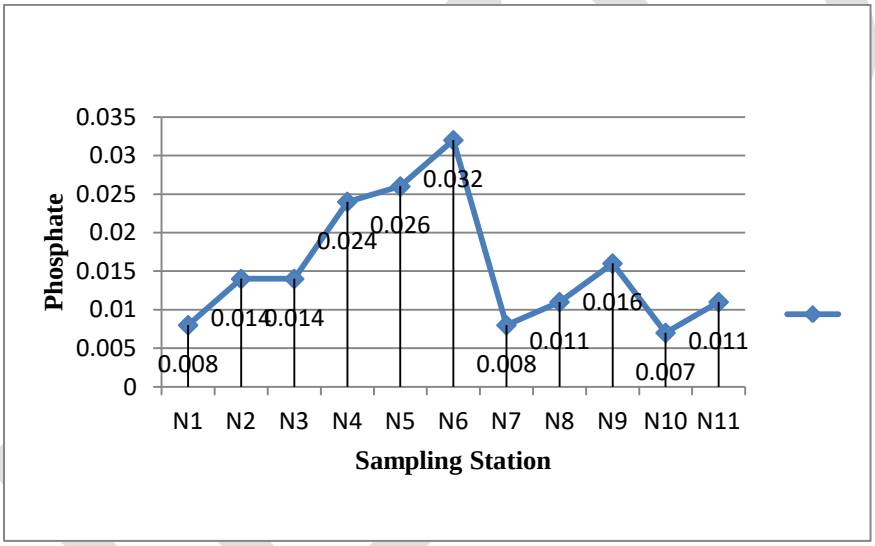

Figure 13- Graph Showing Variation in Phosphate at Different Sampling Station

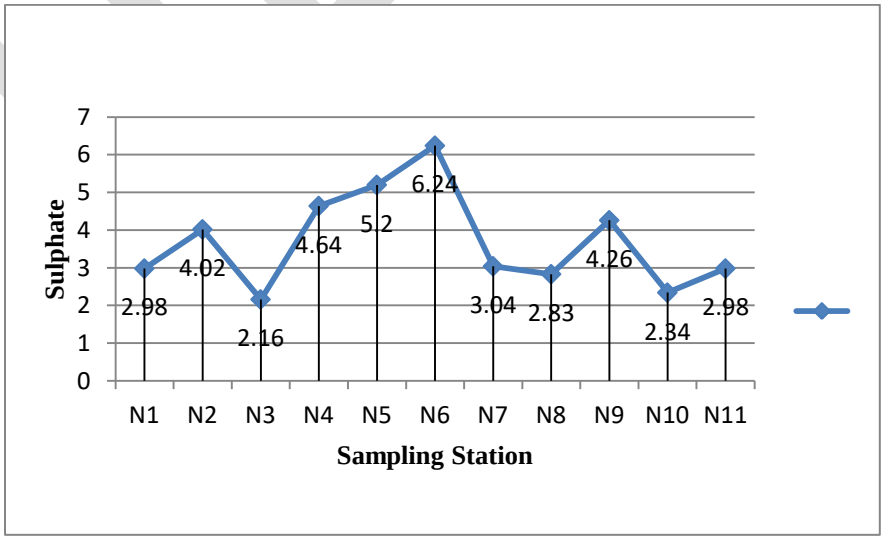

Figure 14- Graph Showing Variation in Sulphate at Different Sampling Station

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