

Seasonal Analysis of Ganga River Sediments in the District of Vaishali, Bihar

Dr Kalpna kumari

1. Dept of Chemistry, B.P.S College Desari, B.R.A Bihar university, Muzaffarpur, 7903463434,

Corresponding Author: Dr Kalpna kumari

Abstract: River or lagoon beds which are ideal habitat for several species of organisms usually serve as a sink for both domestic and industrial wastes from anthropogenic activities. Dumping of such wastes could alter the ecological states of these ecosystems. Hence baseline studies are required to determine the status of sediments and quality to give complementary data on the physicochemical characteristics of the habitats. The present study aims to implement master variables, best characterising the sediment stability. Certain chemical characteristics of sediments of river Ganga at Vaishali district were evaluated during the year 2016-17 in different stations. Organic carbon was slightly varying from one station to another station. Available nitrogen was lower in pre monsoon. The analysis among the sediments characteristics of the river proves the common sources of nitrogen in agriculture run-off during rainy season. However, their different sources of enrichment is marked during winter season. During rainy season the dissolved constituents is responsible for increasing electrical conductivity. During summer the sources of nitrogen is mainly from dead decomposed and decay of living organisms. PH was alkaline throughout the study period. DO (Dissolved oxygen) indicates higher value during post monsoon (6.1 mg/l) which could be due to the cumulative effect of higher wind velocity coupled with heavy rainfall and resulting in mixing with fresh water. The lower value of conductivity (159 $\mu\text{S}/\text{cm}^2$) where observed in the post monsoon and Higher value of TDS where observed in the post monsoon.

Key words: Physico chemical parameters, sediments, aquatic environment, contaminants.

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I. Introduction

Sediments play an important role in elemental cycle in the aquatic environment. They are responsible for transporting a significant proportion of many nutrients and contaminants. Most sediments in surface water derives from surface erosion and comprises a mineral component arising from bedrock and organic component arising during soil forming process (including biological and micro-biological and decomposition). Sediments are classified into two classes. a. deposited sediments (found in lake or bed of river) b. suspended sediments (water column where it is being transported by water movements, mineral and organic solid). The concentration of sand is highest near the bed of river and lowest near the surface. The important component of the suspended load for the geochemical transport are silt, clay, hydrous iron manganese oxides and organic matter. To prevent an ecological disaster with in the river water itself and its adjacent water body important and necessary activity is needed. The sediments stability is determined by measuring different parameters in the laboratory using appropriate device. Physico-chemical and biological factors are known to have a great impact on sediments stability. In the present paper a huge range of physico-chemical and biological properties varies are seasonally determined by different parameters as P^{H} , TDS, Hardness, Turbidity, Conductivity, DO, Dissolved Organic carbon, Nitrogen, Sulphate, Chloride etc.

II. Materials And Methods

Site description:-

10 sites of Vaishali district from 4 different blocks as Bidupur, Mahanar, Sahdei and Raghapur have been selected which has mentioned in Table-1. These sites are located on the bank of Ganga river.



Sediment Sampling:-

Sediment samples were collected in the polythene bags from both sides of banks of river by using boat and transported to the laboratory and analysed. Sediments samples were analysed for most water quality influencing 10 parameters which includes pH, Conductivity, Alkalinity, Nitrogen, Chloride, Sulphate, TDS, Total hardness, Turbidity, Dissolved Oxygen and Temperature.



III. Methodology:-

Table-1: Areas of Vaishali District used for sampling

1.	CHANDPURA	S ₁
2.	KAMALPUR SINGHARA	S ₂
3.	SAHDEI	S ₃
4.	RAGHOPUR	S ₄
5.	GOPALPUR	S ₅
6.	KUTUBPUR	S ₆
7.	GOKULPUR	S ₇
8.	KHALSAGHAT	S ₈
9.	VISHUNPUR (JIMMEDARI GHAT)	S ₉
10.	GANIYARI	S ₁₀

Table 2: Methods used for physico-chemical analysis of water sample

Para meter used	Method used
Ph	pH meter
Electrical Conductivity (EC)	Conductivity Meter
Total dissolved solids (TDS)	TDS Meter
Hardness	EDTA Titration
Dissolved oxygen (DO)	DO Meter
Sulphate	UV double beam Spectrometer Model N.-2202
Temperature	Thermometer
Chloride	UV double beam Spectrometer Model N.-2202
Alkalinity	Titration
Turbidity	Turbidity Meter
Nitrogen	Spectrophotometric Method

IV. Results And Discussion

The physico-chemical parameters exhibited considerable variation from sample to sample. The various observation of sediments are summarised in Table-3 and Table-4 and graph1 to 9.

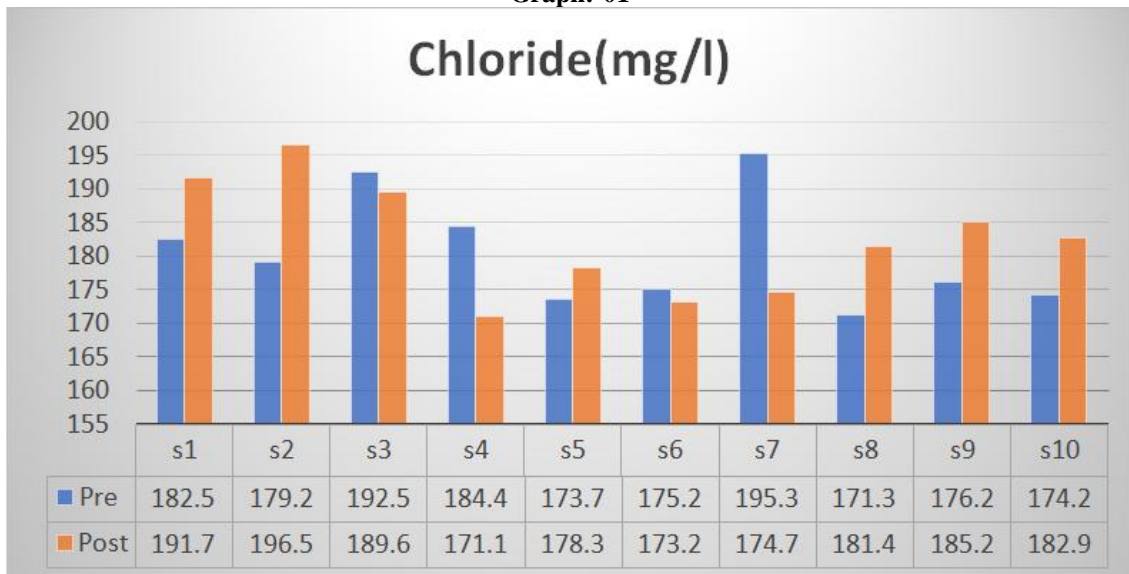
Table-3: Physico-Chemical Parameters Pre monsoon

Parameter	Standard	Monitoring Stations									
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Temp	Normal	26	24	24	25	23	26	27	25	27	26
Ph	6.5-8.5	7.2	7.5	7.9	7.3	7.1	7.6	7.2	7.5	8.0	7.9
TDS (mg/l)	500 (maxm)	523.2	624.4	649.1	661.6	475.5	600.1	728.2	642.1	554.6	661.6
conductivity (µs/cm ²)	250 µs/cm ²	712	756	696	808.2	682	989	1127	792	1052	821
DO (mg/l)	6mg/l	5.3	5.9	5.1	5.0	5.7	5.2	5.8	5.6	5.4	5.3
Organic Carbon	0.05mg/l	0.460	0.381	0.420	0.436	0.361	0.345	0.426	0.418	0.420	0.389
Hardness	300	272	283	280	260	281	270	250	280	240	282
Available Nitrogen	180kg/hectare	150.6	145.2	161.5	134.9	170.8	167.2	143.2	127.3	133.7	140.6
Chloride	250mg/l	182.57	179.24	192.56	184.43	173.77	175.25	195.37	171.34	176.29	174.28
Sulphate	200mg/l	161.22	163.33	164.41	172.21	173.25	177.27	165.51	173.32	169.52	171.43
Turbidity	5 Ntu	12.34	13.23	12.56	12.29	13.81	13.92	13.46	12.89	12.99	14.69

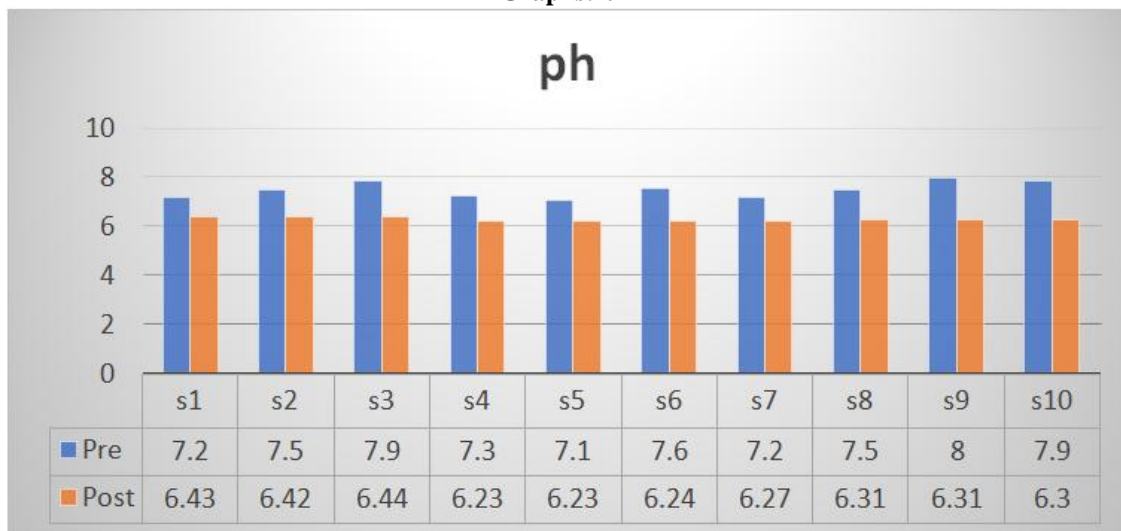
Table-4: Physico-Chemical Parameters Post monsoon

	Standard	Monitoring Stations									
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Temp	Normal	21	23	21	24	22	21	23	22	21	23
pH		6.43	6.42	6.44	6.23	6.23	6.24	6.27	6.31	6.31	6.30
TDS (mg/l)	500 (maxm)	135.3	131.9	127.6	105.3	100.5	58.7	115.4	131.8	125.4	147.2
conductivity (µs/cm ²)	250 µs/cm ²	159	243	233	158	178	103	389	251	248	263
DO (mg/l)	6mg/l	6.0	6.1	5.9	5.7	5.9	5.6	5.8	5.8	6.0	6.1
Organic Carbon	0.05mg/l	0.451	0.436	0.415	0.396	0.373	0.359	0.382	0.373	0.426	0.413
Hardness		263	271	265	252	258	263	276	269	273	279
Available Nitrogen	180kg/hectare	180.2	181.6	175.9	123.8	221.2	210.1	96.8	111.2	94.9	145.6
Chloride	250mg/l	191.73	196.51	189.64	171.14	178.32	173.23	174.72	181.43	185.20	182.91
Sulphate	200mg/l	128.5	142.2	127.6	77.3	94.2	53.9	128.7	113.4	117.2	126.6
Turbidity	5 Ntu	13.63	13.14	13.81	12.24	12.51	12.46	12.71	13.03	12.95	13.41

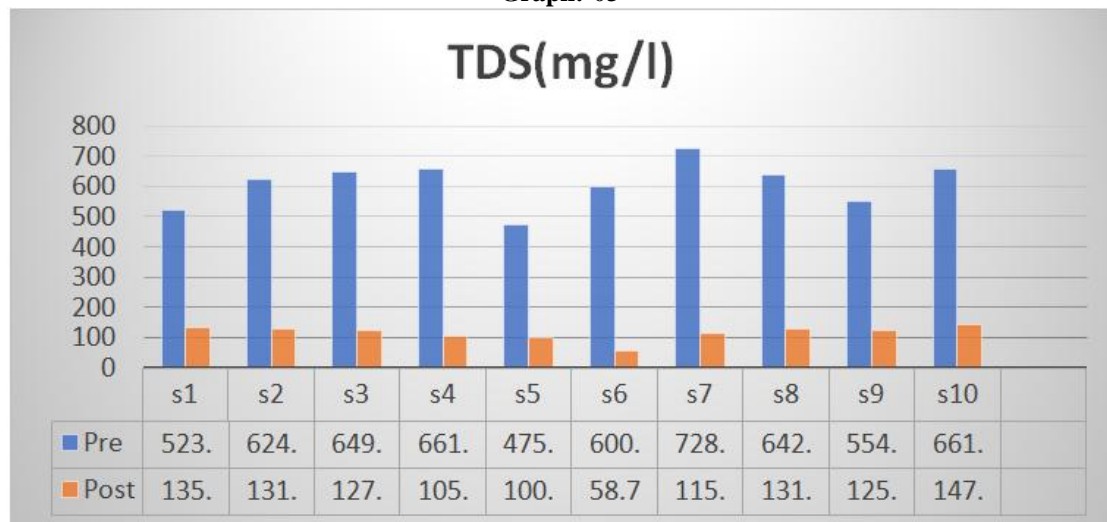
Graph:-01



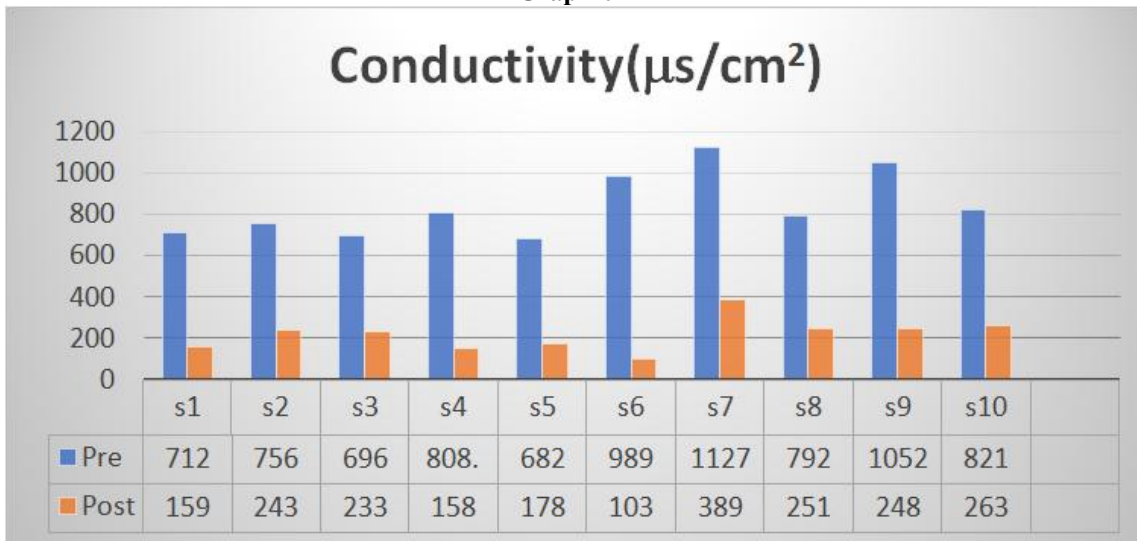
Graphs:-02



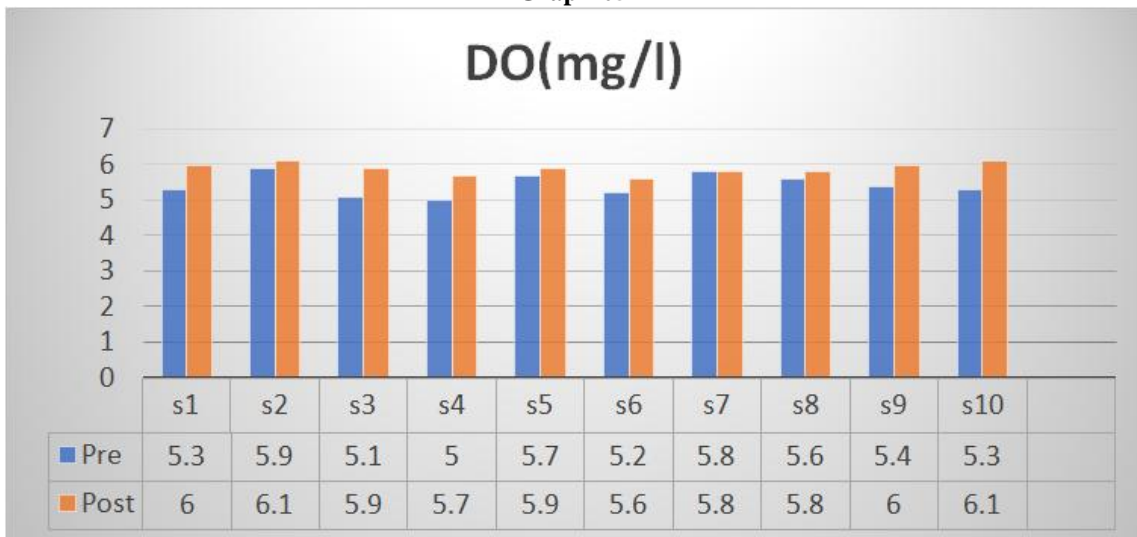
Graph:-03



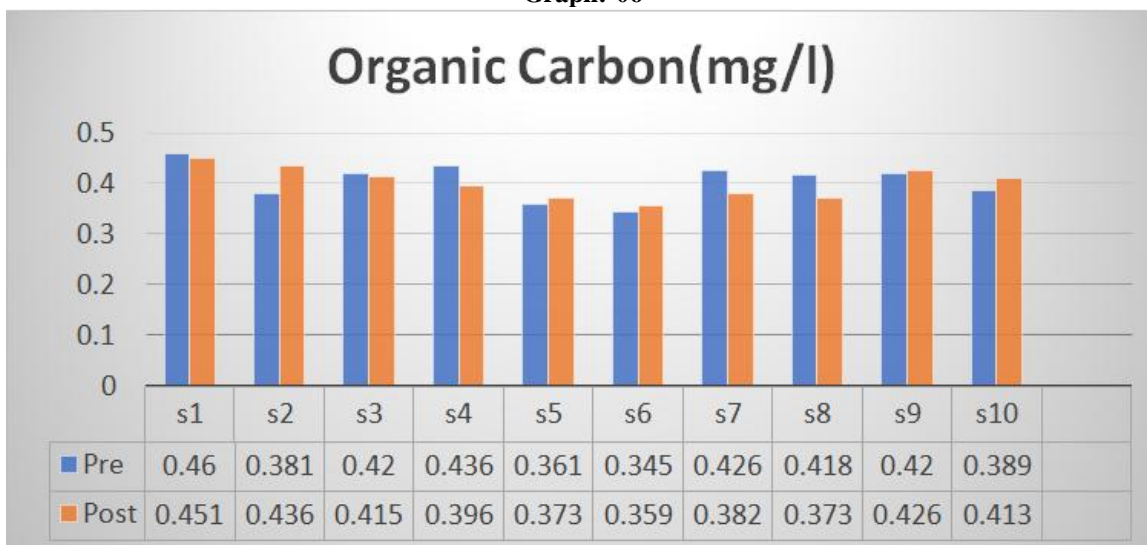
Graph-04



Graph-05



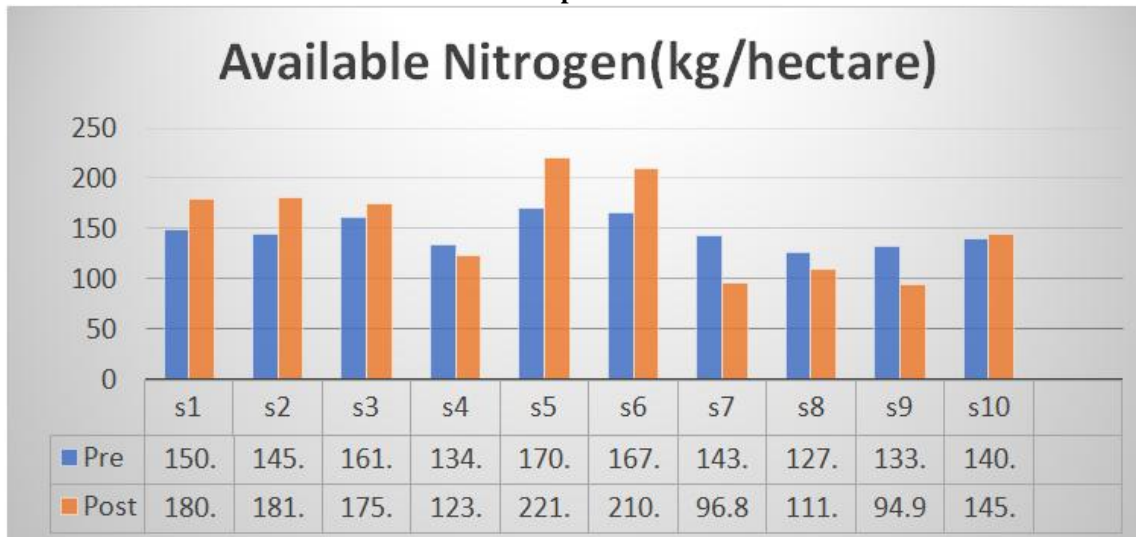
Graph:-06



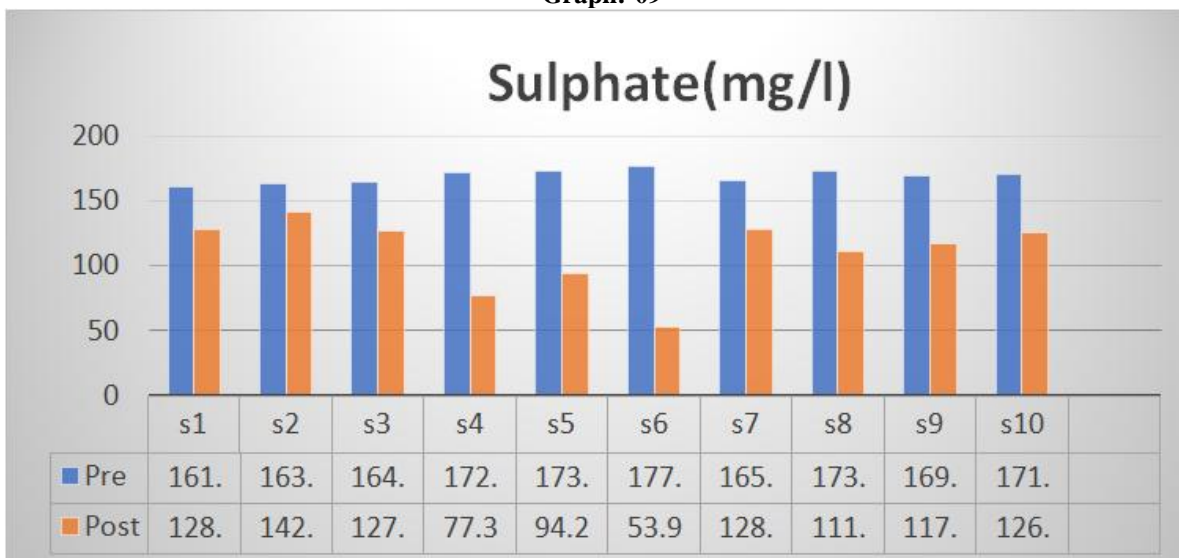
Graph:-07



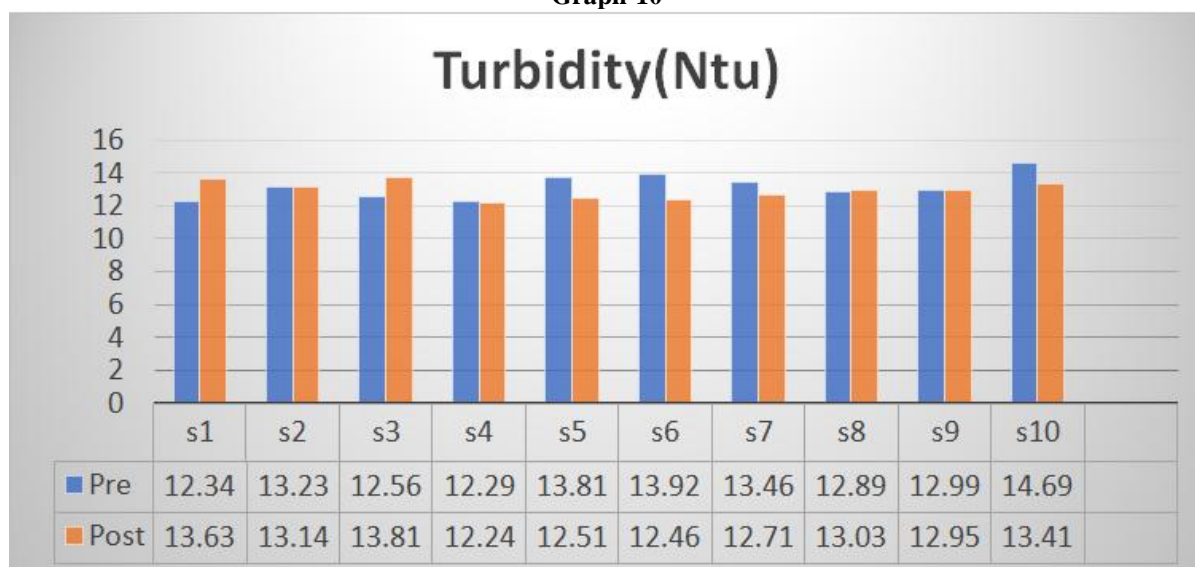
Graph:-08



Graph:-09



Graph-10



APPEARANCE

Temperature:- Temperature effect the chemical equilibrium of sediments and also different chemical and biological reactions.

Ph:- The ph of the sample showed a great variation an it ranged from 7.9 in pre monsoon to 6.23 at s5 in post monsoon. PH was slightly alkaline through out study period at all station.

DO:- DissolvedOxygen is important factor determining the productivity of water body. It is essential for the metabolism of aquatic organisms. During the study period the DO value ranged from 6.1 to 5. The higher value of DO was recorded in the post monsoon at s2 and s10 and lower at pre monsoon at s4 and s5.

TDS :- The TDS value ranged523.2 to 728.2(mg/l). The highest value of TDS 728.2(mg/l) was recorded at station s7 in pre monsoon and lowest value was recorded at the station s6 in post monsoon.

Electrical Conductivity(EC):- Electrical Conductivity was recorded higher in pre monsoon comparatively post monsoon.

Alkalinity and total hardness:- Alkalinity is the parameter of water quality use to describe the effect determining suitability of water of sediments for domestic, Industrial and drinking purpose. It is govern by the content of calcium, magnesium and iron. Organic acid such as humic acid also form salt that increase alkalinity. Alkalinity itself little public health significant, although highly alkaline water are unpalatable and can cause gastro in testinal discomfort. In the present study higher value was observed in pre monsoon at station at s2(283) and lower in post monsoon at station s4(252).

Chloride:- Chloride concentration serves as an indicator of pollution. The sea wage water and industrial influent are rich in chloride. Chloride ion ranged form 171.34(mg/l) to 195.7(mg/l) in the pre monsoon.The maximum value was found in the station s7 in pre monsoon and minimum value was found in the station s4 in 171.14(mg/l) monsoon.

Turbidity:- The Turbidity ranged from 12.29 to 12.99(Ntu) in pre monsoon and 12.24 to 12.95(Ntu) in post monsoon.

Sulphate:- The Sulphate contents in the sample where ranged from 161.22 to 177.27(mg/l) in pre monsoon and 77.3 to 142.2(mg/l) in post monsoon.

Organic carbon was higher in rainy season. Available nitrogen was lower in rainy season. The analysis among the sediments characteristics of the river proves the common sources of nitrogen in agriculture run-off during rainy season.however,their different sources of enrichment is marked during winter season.During summer the sources of nitrogen is mainly from dead decomposed and decay of living organisms. PH was slightly alkaline in pre monsoon.DO (Dissolved oxygen)indicates higher value during monsoon which could be due to the cumulative effect of higher wind velocity coupled with heavy rainfall and resulting in mixing with fresh water.Conductivity slightly decreases in the post monsoon season and TDS decreases in the post monsoon.

V. Conclusions

The present study aims to implement master variables, best characterising the sediment stability. Certain chemical characteristics of sediments of river ganga at Vaishali district were evaluated during the year 2016-17 in different stations. The ph value recorded where in the accepted levels. Higher ph during pre monsoon wereobserved due the removal of carbon dioxide by photosynthetic organism(Biological effect) and

lower pH observed during post monsoon in all stations could be attributed to the dilution of saline mangrove by fresh water in flow.

Seasonal variation of dissolved oxygen is mainly due to fresh water flow and terrigenous impact of sediments. Electrical conductivity is a measure of total dissolved solids and salinity. Electrical conductivity were observed higher in pre monsoon comparatively post monsoon indicating accumulation of salt or mineralization of organic matter. Seasonal variation of hardness is due to Anthropogenic influences. Organic carbon were higher in rainy season available nitrogen was lower in rainy season. The analysis among the sediments of the river prove the common sources of nitrogen in agriculture run-off during rainy season however the different sources of enrichment is marked during post monsoon during pre monsoon the sources of nitrogen is mainly from decompose and Decay of living organism. TDS were higher in pre monsoon due to faster evaporation.

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