Seasonal Variation in Physico Chemical Properties of Water in Shivnath River, Durg, (Chhattisgarh)

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Abstract: The seasonal changes on physicochemical parameters in water quality of Shivnath river, Dist. Durg, (C.G) was aimed to study. Shivnath River in Chhattisgarh State is considered as Life line of Chhattisgarh, which covers about 290 km. Three different location were selected for study, first area **Piperchhery,** second **Mahamarra Ghat**, and third **Changory**. Twelve water parameters including temperature, pH, total alkalinity, chlorides, total hardness, nitrate, chemical oxygen demand, BOD, DO, sodium, potassium, total phosphorus, were analyzed on three different location. Parameters that determine water quality were measured during the month of rainy and summer that represent two seasons. Comparison made between the three different locations, the obtained result shows that there is variable in the water quality from rainy and summer. The cluster analysis showed that the seasonal change in surface water quality, which is usually act as an indicator of pollution from Rainfall or other source. The value of different physic – chemical properties varies with seasons and the highest values of pollution were recorded in the Rainy season in Mahamarra Ghat. To maintain the healthy ecosystem of the river, proper management and monitoring of water quality of the river is needed.

Keywords: Physico-chemical parameter, water quality, pollution, Seasonal variation, Shivnath River.

Introduction: Water is an essential natural resource and is vital for all forms of life. 70.9% of the Earth's surface is covered by the water. 96.5% of the planet's water is occupied in oceans, 1.7% in the form of groundwater,1.7% in glaciers and the ice caps of Antarctica and Greenland 0.001% in the air as vapor, clouds and precipitation. Only 2.5% of the Earth's water is fresh water, and 98.8% of that water is in ice and ground water**.(Upadhyay *et al.* 2014).**

Many small and big rivers co-originate in Chhattisgarh state. Mahanadi River is the most important river of the state and is also known as the life line of Chhattisgarh. Shivnath River in

Chhattisgarh State is 290 km. It emerges from Panbaras range situated at the height of 625 meters, at Ambagarh tehsil of Rajnandgaon district. After emerging from Panabaras it flows about 40 km to the north direction & then turns its flow towards east direction at Ambagarh Chouky. Rajnandgaon, Durg and Janjgir, Champa district are some of the main areas situated at the bank of Shivnath River. Arpa, Lilagar, Maniyari, Kharoon, Aabar, Surahi, Tandula *etc* are the main tributaries of Shivnath River . Due to dumping of variety of wastes (Industrial as well as domestic) Shivnath river is facing a huge problem of pollution. The Assessment of impact of the discharges on the physicochemical and microbiological quality of the Shivnath river water in Durg district**.(Belorkar *et al*.2010).**

In this work, we assessed the physiochemical parameters of water in river shivnath of three different water site first is Changory, second is Mahamarra Ghat and third is Piperchheri in Durg district in India. Physicochemical parameters are considered as an important water quality parameters, of river water i.e. pH, temperature, turbidity, conductivity, total dissolved solids, total suspended solids, total alkalinity, sulfate, nitrate, heavy metals, and phosphate. India was once bestowed with abundant freshwater reserves like various rivers & ground water reserves. The Quality of surface and ground water is a very sensitive issue in the present scenario. Ponds & rivers play major role in controlling the global hydrologic cycle. These are the most dynamic part of water transport system. Ponds and rivers are the vital and vulnerable freshwater ecosystems that are critical for the sustenance of all life **(Khatoon *et al*. 2013).**

Material and Methods:

Study area: Durg is important district of Chhattisgarh with latitude 21.1623^0 N and longitude 81.6296^0 E. Shivnathriver is one of the important river in Chhattisgarh. The Shivnath river originated from Panabaras hill, 624meters (2047ft) above sea level in the Ambagarh Chouki division of Rajnandgaon district of Chhattisgarh. Shivnath river is longest tributary of Mahanandi river. 3 different location will be selected for present study in shivnath river from drug district, 1st location will be Changori (latitude21.0839 ^{0}N and longitude 81.2388 ^{0}E), the 2nd location is Mahmara – Ghat (latatitude21 ^{0}09’ 55.3” N and longitude 81 ^{0}14’21.6” E.) and the 3rd location will be Piperchhery with latitude 21.2038 ^{0} N and longitude 81.2346 ^{0} E.

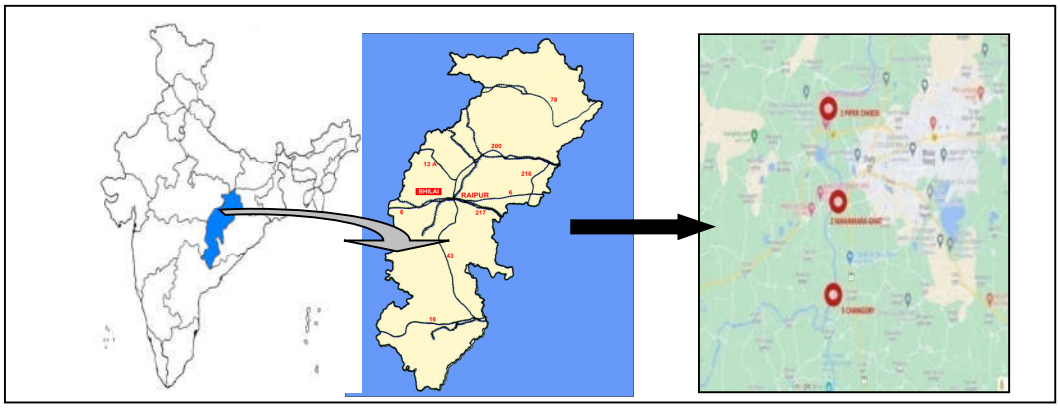


Figure 01: Map of Study Area

Collection of water sample: Water sample from different sites of Shivnath River were collected in Cans in the Summer and Rainy season. Water Samples were collected from a depth of 25-30cm. Water samples were collected, preserved and transported to the laboratory as per standard methods of analysis. The water samples were analyzed for the subsequent 12 water quality parameters: (1) Temperature,(2) pH, (3) Alkalinity, (4) Chlorides, (5) Hardness, (6) Nitrate, (7) Chemical

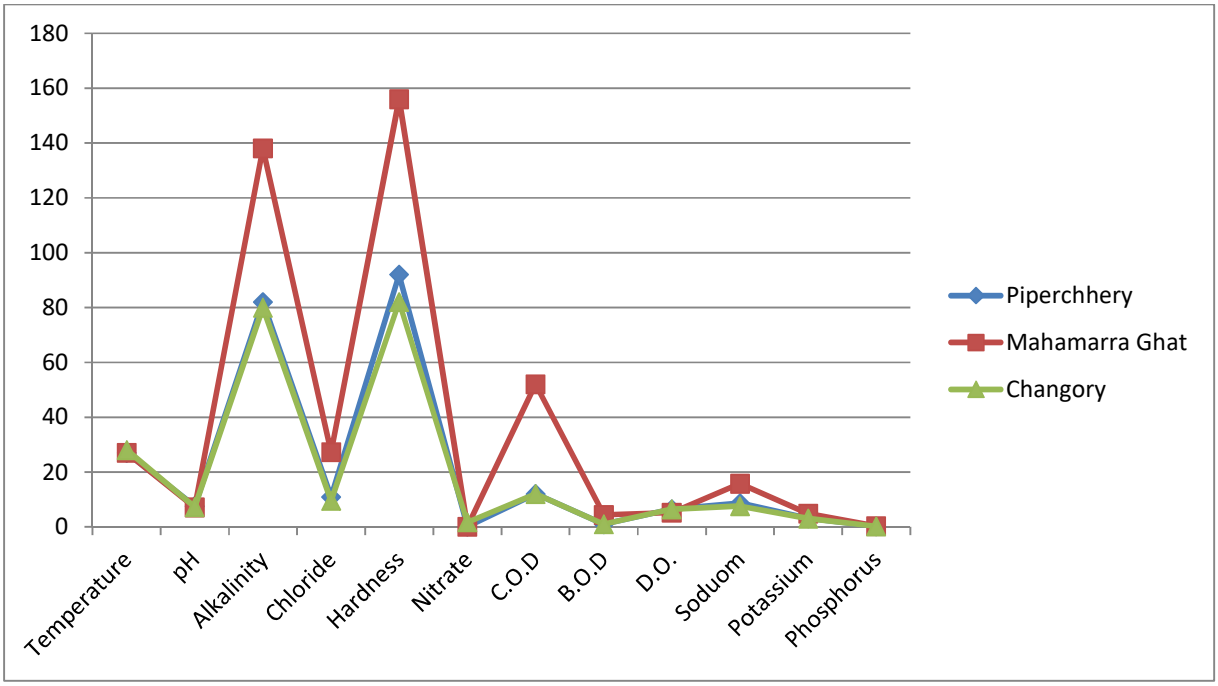
Oxygen demand (COD), (8) Biochemical oxygen demand (BOD), (9) Dissolved oxygen (10)Sodium, (11) Potassium, (12) Phosphorus and all parameters were analyzed within the laboratory. Water temperature was measured by the thermometer Celsius scale in the field. pH were measured with an electronic digital instrument pH meter. Chemical parameter such as Dissolved Oxygen (DO) was measured by Winkler titration method and COD was measured by titrimetric method, Biological Oxygen Demand (BOD) was measured by 5 days BOD test (UEPA, 1986), Chemical Oxygen Demand (COD) measured by titration method (APHA,1915) and total Alkalinity will be determined by titrimetric method. Chloride (Cl) ion was measured by Argentometric method. Hardness is determined (calcium hardness) by EDTA titrimetric method and Nitrate was measured by phenoldisulphonic acid method. Sodium measured by flame photo metric method and phosphate measured by stannous chloride method.

Result and Discussion: Monitoring the river water quality is vital for managing the river ecosystem. The given following finding results in present study of Shivnath river water quality examining twelve (12) parameters.

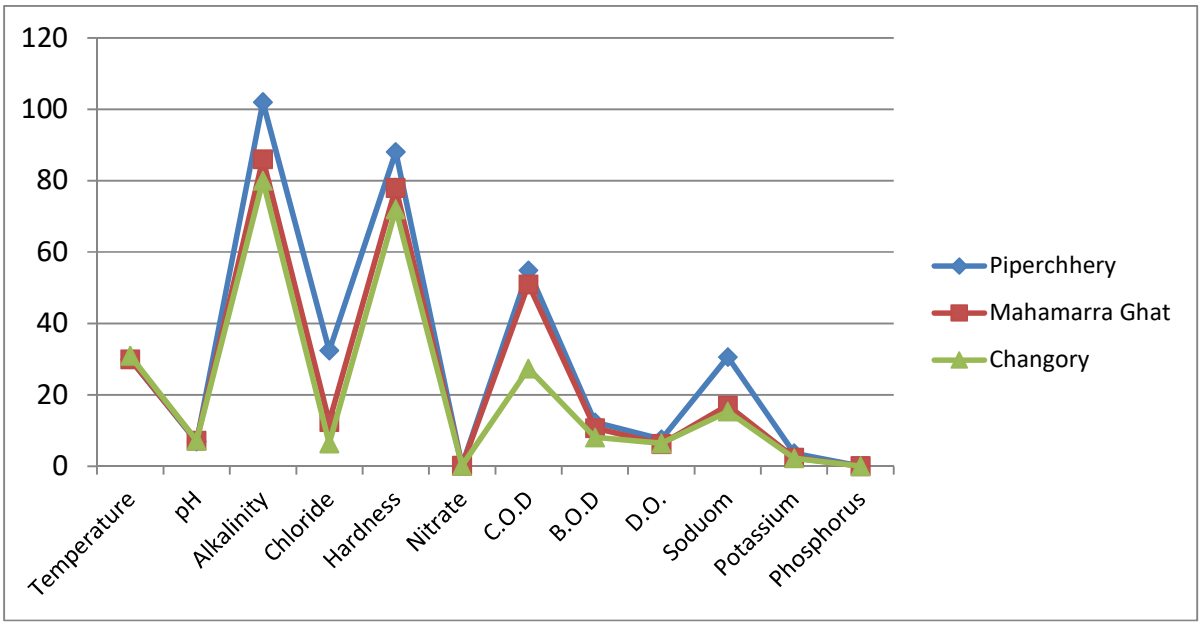
Table No. 01: Seasonal Variation of Three different sites of Shivnath River (Physico-chemical Parameters)

S. no.	Parameters	Unit	Piperchhery		Mahamara ghat		Changory	
			Riany	summer	Rainy	Summer	Rainy	Summer
1	Temperature	_	27	30	27	30	28	31
2	pH	_	7.60	6.98	7.07	7.25	7.22	7.24
3	Alkalinity	mg/l	82	102.0	138	86.0	80	80.0
4	Chlorides	mg/l	10.89	32.49	27.23	12.49	9.52	6.49
5	Hardness	mg/l	92	88.0	156	78	82	72.0
6	Nitrate	mg/l	0.1	0.23	0.1	0.21	1.68	0.17
7	C.O.D.	mg/l	12	54.88	52	50.96	12	27.44
8	B.O.D.	mg/l	1.0	12.30	4.40	10.71	1.0	8.15
9	D.O.	mg/l	6.4	7.6	5.2	6.3	6.5	6.5
10	Sodium	mg/l	8.7	30.6	15.8	17.1	7.6	15.4
11	Potassium	mg/l	3.2	3.7	4.9	2.5	3	2.3
12	Phosphorus	mg/l	0.18	0.07	0.28	0.07	0.16	0.08

Graph o. 01: Rainy season three sites



Graph o. 02: Summer season three sites graph -

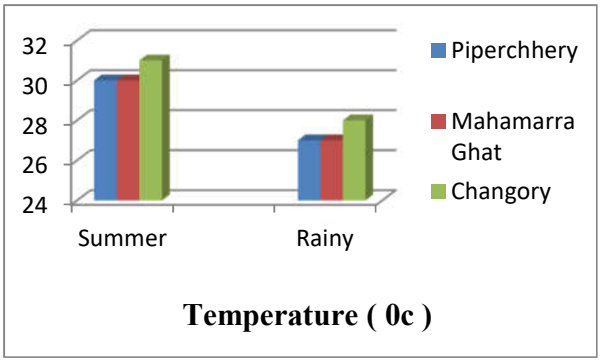


Temperature –Temperature is very important for water to manage quality. It is responsible for all change of physicochemical parameters of water. The rate of chemical reactions generally increases at higher temperature. In the present study, the temperature of the river was recorded

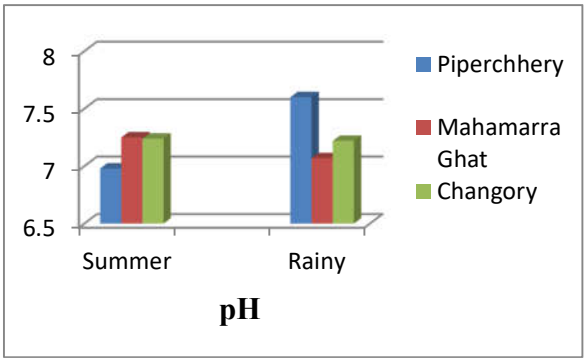
27°C to 28°C during rainy Season. Relatively in the summer season, the temperature was recorded 30^0C to 31°C in morning time. The present study recorded maximum temperature in during summer Season, 31°C. So, the study area water temperature was favorable for drinking water supply and managing aquatic ecosystem.

pH –pH plays vital role to examine the water quality assessment as it has great influence on biological and chemical processes in the water body. In the study area the pH of water collected at different points and at different times of year ranged from 6.98 to 7.60. The highest pH was found 7.60 at the Piperchhery and the lowest pH was found 7.07 in the shivnath river during the Rainy season. On the other hand, the pH of water was low during the summer season pH ranged from 6.98 to 7.24 in the Shivnat river. It's express the Shivnath river water pH was high. But all these pH values at different times of year were within the permissible limit. There was no significant variation in pH values in this analysis. So the study area water was weak alkaline.

Comparison of Temperature-



Comparison of pH -

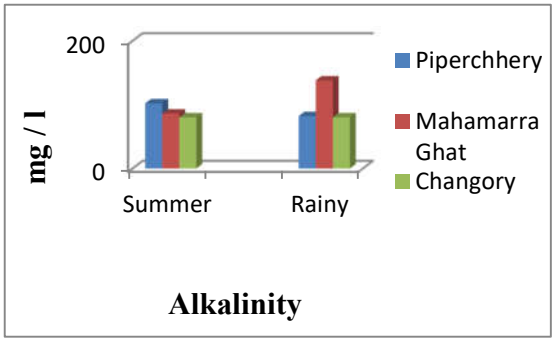


Total Alkalinity-The importance of total alkalinity provides information about natural salts present in the water. Natural water contain high alkalinity are more in phytoplankton, mainly due to the blue greens. It is major cause for production of an aquatic ecosystem. Total alkalinity of stream water is produced by the cat ions of Ca, Mg, Na, K, NH_3. Total alkalinity present in river water is 80 – 138 mg/l. in Rainy season and highest alkalinity in 138 mg/ lit. at Mahamarra Ghat and lowest value in alkalinity in 80 mg/lit. in Changory. in the summer season alkalinity vary 80–102 mg/lit. The highest alkilinity in 102mg/l in Piperchherysite and lowest alkalinity in 80 mg/l. in Changory site.

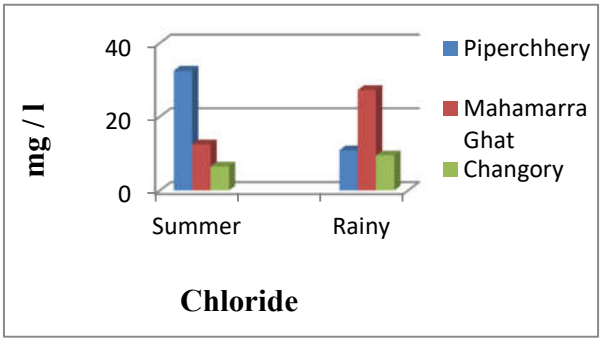
Chlorides -In the present study Chloride (Cl) ion was recorded as ranged from 6.49-32.49 mg/L in the Shivnat river during Summer season. The maximum Chloride (Cl) was recorded 32.49 mg/L respectively site Piperchhery. Else, to found variation of Chloride (Cl) value one to another season in the Shivnath river. The Chloride (Cl) ion measured 9.52-27.23 mg/L in rainy season. The highest Chloride (Cl) ion was recorded 27.23 mg/L at the sample site Mahamarra Ghat. The lowest Chloride (Cl) ion was found many more sample sites in study area.

Total Hardness -The value of Total Hardness varied from 72 - 88 mg/L during the Summer season, while it was from 82- 156 mg/L during the rainy season. The hardness of water occurred due to the presence of sulphates and chlorides of Ca and Mg, or Fe, Mn and Al in some cases. The temperature which increases with the concentrations of salts by more evaporation may increase the hardness of water.

Comparison of Alkalinity -



Comparison of Chlorides –



Nitrate –The seasonal variation of nitrates present in the Shivnath river water is shown in in the water may vary from 0.17 to 0.23mg/lit in summer season. The nitrates concentration in the water is found highest in 0.23 at Piperchhery in Summer season.. In the minimum concentration is found 0.17mg/lit in Changory site, rainy season nitrate amount vary 0.1 – 1.68 mg/l.

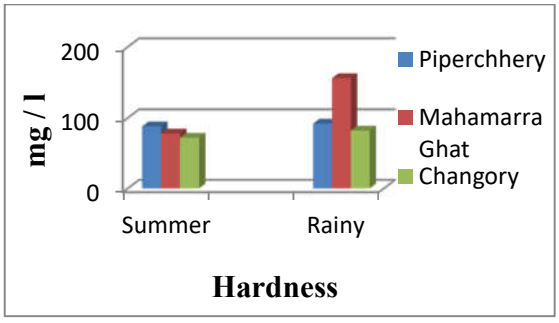
C.O.D. - In the present study COD value recorded ranged from 12 mg/L to 52 mg/L during Rainy season. The lowest COD value was recorded 12 mg/L in the Piperchhery and Changory sites and highest COD value was recorded 52mg/L in the Mahamarra Ghat of the Shivnath River. Behavior of COD was opposite to DO. Comparatively the COD value was recorded moderately

high during Summer season (27.44 mg/L to 54.88mg/L) in the Shivnat river. The highest COD value was found 54.88 mg/L at the Piperchhery at Shivnath river. Relatively maximum COD value may cause oxygen depletion on reason of decomposition by microbes to a level detrimental to aquatic life.

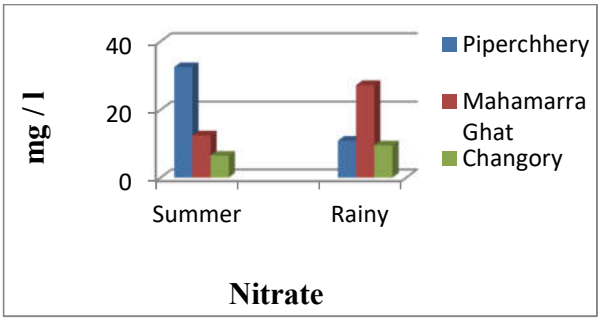
B.O.D. –Biochemical oxygen demand ranged from 8.15mg/L to 12.30 mg/L in the Shivnath river during Summer season. The lowest BOD level was recorded 8.15 mg/L in the site Changory and relatively the highest BOD level was recorded 12.30 mg/L in the Piperchhery, which site was located at Shivnath River. On the other hand, during rainy season the BOD value was ranged from 1.0 mg/L to 4.40 mg/L. Maximum BOD value recorded 4.40 mg/L in the Mahamarra Ghat at the Shivnath river, which receives organic or domestic waste of durg city etc.

D. O. –Dissolved oxygen concentration of the Shivnath river water was significantly low during Rainy season (value in the ranged of 5.2 to 6.5 mg/L). The lowest dissolved oxygen of water was found 5.2 mg/L at the Mahamarra Ghat, and the highest dissolved oxygen was found 6.5 mg/L at the Changory. Dissolved oxygen ranged from 6.3to 7.6 mg/L and the highest dissolved oxygen was found 7.6 mg/L.

Comparison of Hardness -

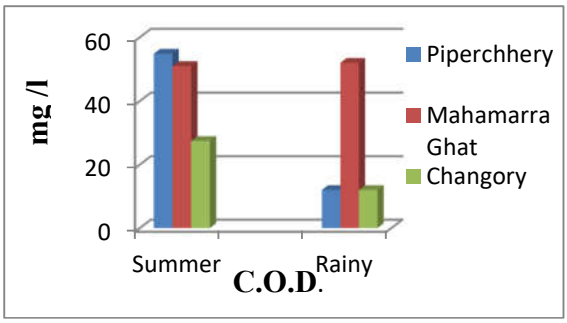


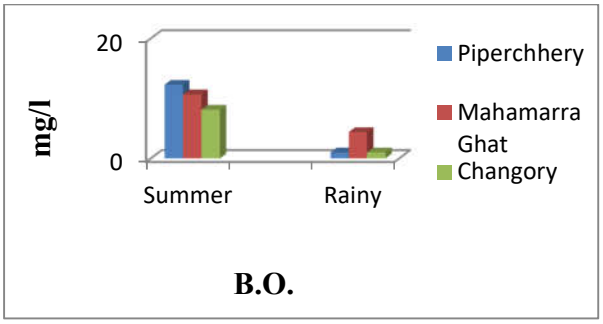
Comparison of Nitrate –



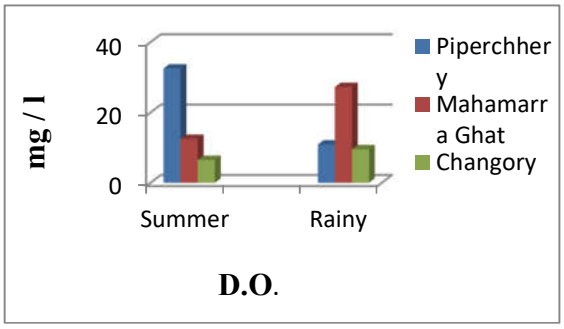
Comparison of C.O.D. -

Comparison of B.O.D

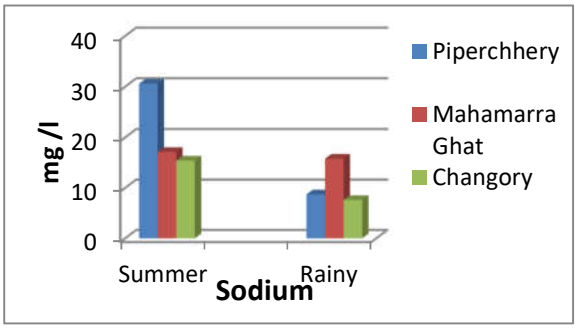




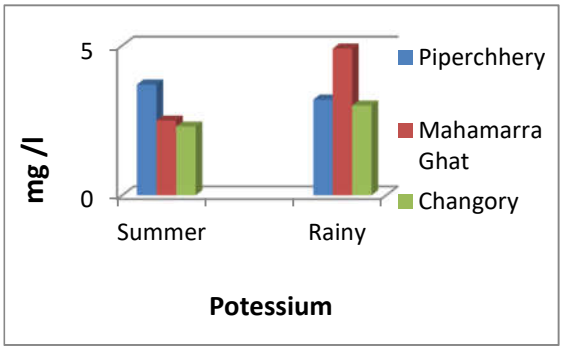
Comparison of D.O. -



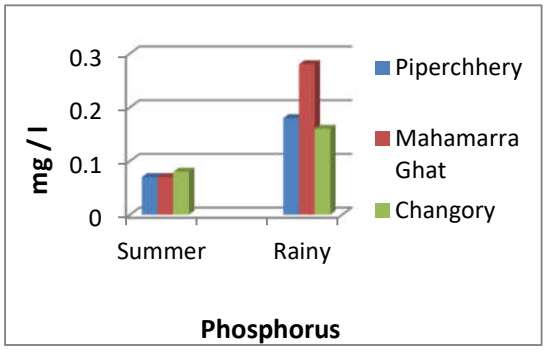
Comparison of Sodium -



Comparison of Potassium -



Comparison of Phosphorus -



Sodium – In the present study sodium was recorded as ranged from 15.4-30.6 mg/L in the Shivnat river during Summer season. The maximum sodium was recorded 30.6 mg/L respectively site Piperchhery. Else, to found variation of sodium value one to another season in the Shivnath river. The sodium measured 7.6-15.8 mg/L in rainy season. The highest sodium was recorded 15.8 mg/L at the sample site Mahamarra Ghat. The lowest sodium was found in 7.6 mg/l. in Changory sample sites in study area.

Potassium –In the present study potassium was recorded as ranged from 2.3- 3.7 mg/L in the Shivnat river during Summer season. The maximum potassium was recorded 3.7 mg/L respectively site Piperchhery. The potassium measured 3 – 4.9 mg/L in rainy season. The highest potassium was recorded 4.9 mg/L at the sample site Mahamarra Ghat. The lowest potassium was found in 3 ml/L in Changory.

Phosphorus - The concentration of phosphorous present in the Shivnath river water is found 0.16–0.28mg/lit in Rainy season. The highest concentration is found 0.28mg/lit at the Mahamarra Ghat and lower concentration 0.16mg/lit is found at Changory. On the other hand phosphorous present in the Shivnath river water is found 0.07–0.08mg/lit in summer season. The excessive amount causes algal bloom, those decreases the sunlight came to more vegetation.

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