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Research Article

Evaluation of phytoplankton diversity with Physicochemical parameters of Hemmat River, Kodinar Gujarat, India

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Abstract

Plankton refers to plants and animals that drift with the ocean currents and fresh river water .they habitants in the open waters of the sea and fresh river water. Phytoplankton always live near the surface of the sea and fresh water because, they require light for photosynthesis, they play important roll in transformation of water and carbon dioxide in to short chain sugars. The plants in the pelagic zone are exceptionally small, microscopic, and single-celled, buoyantly supported by the density of the surrounding water. Physico-chemical parameters are very important factors that play a significant role in river plankton diversity and fluctuation. We evaluated impact of Abiotic factor on plankton diversity during pre, middle and post winter analysis of Hemmat River.

Keywords: Physico-chemical property of water, plankton, diversity of plankton.

1. Introduction

Plankton is organisms which live suspended in the water of seas, lakes, ponds, and rivers, and not able to swim against the currents of water. This latter feature distinguishes plankton from nekton, community of actively swimming organisms like fish, larger cephalopods and aquatic mammals.

There are two major groups of phytoplankton: (l) non motile, fast-growing diatoms (2) motile flagellates and dinoflagellates, which can migrate vertically in the water column in response to light. Each group exhibits a tremendous variety of cell shapes, many with intricate designs and ornamentations. The diatoms are further divided into two groups based on cell shape: (1) Pennate diatoms, which evolved first during the Late Cretaceous, are long and (2) centric diatoms, which evolved later than the pennates, are shaped like pallboxes and may have elaborate arrays of spines projecting from their cell walls.

Phytoplankton has varied in physical and chemical requirements for population growth. Diatoms differ significantly with respect to motility, cell-wall composition and ornamentation, and nutritional and reproductive strategies.

Diatoms have cell walls, called frustules, made of silica (the same material in glass and opal). In contrast, Dinoflagellates can have a rigid cell-wall, called a theca, made of cellulose plates, or they can have a non rigid cell membrane (no theca).these two forms of Dinoflagellates structures gave rise to the terms “armored” and “unarmored”(or “naked”) Dinoflagellates.

Diatoms and Dinoflagellates can be highly ornamented, which aids in species identification. Cell-surface design on some diatoms may help focus light on chloroplast, allowing survival at greater depths where light intensity is very low. Long spines, cell shape, and the formation of chains and colonies make diatoms more difficult for predators to grasp or bite and also assist in flotation .Some Dinoflagellates form chains, whereas others have protuberances that look like wings, crowns, or horns, for similar reasons. Both groups commonly reproduce by simple cell division. Some species of diatoms and Dinoflagellates are known to produce resting stages. Resting spores in diatoms, and cysts in Dinoflagellates, allow species to survive in unfavorable condition. Dinoflagellates species have feeding veils that are extruded around such food items as diatoms. Both groups are able to absorb nutrients and vitamins into the cell and have distinct preferences for the forms of some of those nutrients.

In present study we selected Hemmat River of Kodinar taluka, Gir-somnath district, Hemmat is most important and very useful river in kodinar taluka. River water is utilize for many proposed for irrigation and cultivation of fish in river check dam water. We selected 11 abiotic parameters for investigation and studied their impact on plankton diversity of river water. We selected two points for river water sampling and studied their Physico-chemical and plankton diversity during pre, middle and post winter during 2015-2016.

2.1 Materials and Method

2.1 Sample collection site of Hemmat River

Hemmat River is Valuable River of Kodinar Taluka, this river pass through Pedhavada Village and Join with Singoda River. We selected two points for water sample collection, we collected 5 liter sample for physicochemical analysis approximately less than 2 feet of river water. Time and temperature measured during sampling and transferred all sample as soon as possible to laboratory for study further testing. We collected all samples during winter time and temperature range between 25 to 30 ^{0}C.

2.2 Sample collection for phytoplankton Analysis

Collected 1 liter river water sample from two collection site with Plankton net (0.20 microne). After collection of river water samples it's transferred as soon as possible to laboratory for Analysis. Add 4% formalin solution and stay it for 48 hrs, after incubation time period drop count Method is used for identified plankton diversity.

2.3 Physico-chemical parameters

2.3.1 Color

Color in water may result from the presence of natural metallic ions (iron & manganese) humus and pit materials, planktons, weeds.

Apparent color is determined on the original sample with thought filtration or centrifugation by Visual comparison method. We took water sample in clean test-tubes and visualize it that river water is clear or not.

2.3.2 Turbidity

The term "turbid" is applied to water containing suspended matter that interferes with the passage of light through to water. The turbidity in water is caused by suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter and microscopic organisms.

Turbidity is an expression of optical property that causes light to be scattered and absorbed rather than transmitted.

2.3.3 Odour:

Odour can measure by simple nose smell testing.

2.3.4 PH:

PH is a term used rather universally to express the intensity of the acid or alkaline conditions of a solution.

It is a way of expressing the hydrogen ion concentration.

Acidity:

Acidity of water is it's quantity with strong base to a designated PH. Strong mineral acids, weak acid and hydrolyzing salts such as iron or aluminum sulfates may contribute to the measure acidity according to the method of determination. Acid contribute to the corrosiveness and influence chemical reactions and biological processes.

Alkalinity:

The alkalinity of water is a measure of its capacity to neutralize acids. The major portion of the alkalinity in natural water is caused by three major classes of materials: 1) Hydroxides 2) carbonates 3) bicarbonates.

Auto PH meter is used for taking pH of river water sample.

2.3.5 Conductivity:

Conductivity meter instrument is use for measuring conductivity of water sample.

2.3.6 Estimation of Total solid (T.S.)

Porcelain dish is used for this method; Heat it for 103 to 105 C for 1 hrs. Store and cool dish in desiccators until needed weight immediately before use. (Pre weight) Shake the water sample very well and add 100ml of it in to evaporating Petri dish. Put evaporating dish in to oven at 103 to 105 C for overnight. Next day take out it from oven and cool it in desiccators dish would be having dried residues in it. Measure the weight of evaporating dish. (Post weight)Put the data or pre weight and post weight of the dish in following equation and calculate the amount of total solid present in the sample.

Calculation:

mg total solids/L= (A-B).1000/Sample volume (ml)

Where,

A=post weight of dish (weight of dried residues +dish mg)

B= Pre weight (weight of dish mg.)

2.3.7 Estimation of Total dissolved solid (T.D.S.)

Porcelain dish is used for this method; Heat it for 103 to 105 C for 1 hrs. Store and cool dish in desiccators until needed weight immediately before use. (Pre weight)Shake the water sample very well and add 100 ml of it in to filtration device that is having glass fiber on it. Apply vacuum and filter out 100ml of sample. Collect the filtrate in to evaporating dish. Put evaporating Petri dish in to oven at 103 to 105 C for overnight. Next day take out it from oven and cool it in desiccators dish would be having dried residues in

it. Measure the weight of evaporating dish. (Post weight) Put the data of pre weight and post weight of the dish in following equation and calculate the amount of total solid present in the sample.

Calculation:

Mg total dissolved solid/L= (A-B). 1000/sample volume (ml)

Where,

A=Post weight of dish (weight of dried resdues+dish, mg)

B=pre weight (weight of dish, mg)

2.3.8 Estimation of chloride in water sample

Sample preparation: Take 100ml of sample in 250ml conical flask. If chlorine is higher in the sample, dilute the sample and then take 100ml of diluted sample. If the sample is highly colored add 3ml Al $(OH)_3$ suspension, mix, settle and filter.

Titration: Set the pH of the sample in the range of 7-10 with the help of H_2SO_4 /NAOH.

Add 1ml K_2CrO4 indicator solution. Titrate it with standard AgNO3 Titrate to a pinkish yellow end point. Be consistent in end point recognition.

Calculation:

[1] mg Cl/L= (A-B).N.35450/ml of sample (100ml)

Where, A=ml titration for sample, B=ml titration for blank, C=normality of AgNO5 (0.0141N)

[2] mg NaCl /L=(mg Cl/L).1.65

2.3.8 Total water hardness:

Take 1ml of water samples than added few drops of the ammonium bisulphate solution add to black-T as indicator.

We observed that water sample color is occurrence pink. Then added EDTA slowly drops by drop and water color is blue.

Calculation:

Formula: 1000.1ml of used in EDTA/ml of water sample

2.3.9 Estimation of dissolved oxygen (D.O)

Collected river water samples in B.O.D. bottle having capacity of 300 ml. In this bottle add 1ml MnSo4 solution followed by addition of 1ml alkali iodide acid reagent. Stopper the bottle carefully to exclude and mix by inverting bottle a few times. When precipitate has settled sufficiently an (approximately Half the bottle volume.) To leave clear supernatant above the magnisium hydroxid flask. Add 1ml concentrated H_2So_4. Res topper the bottle and mix it thoroughly to completely dissolve the precipitates. Take 200ml of this mixture from bottle to flask.

Add 1ml 2% starch solution as indicator. Titrate it with 0.025 $Na_2S_2O_3$ solutions. Record the end point, when the blue color of starch disappears.

Calculation:

V_1.0.1.1000/200 Where, v1=Burette no.

2.3.10 Estimation of biological oxygen demand (B.O.D)

Collected river water samples in B.O.D. bottle having capacity of 300 ml. In this bottle add 2ml MnSo4 solution followed by addition of 1ml alkali iodide acid reagent. Stopper the bottle carefully to exclude and mix by inverting bottle a few times. When precipitate has settled sufficiently an (approximately Half the bottle volume.) To leave clear supernatant above the managnishy droxid flask. Add 2ml concentrated H_2So_4. Restopper the bottle and mix it thoroughly to completely dissolve the precipitates. Take 200ml of this mixture from bottle to flask. Add 2 ml 2% starch solution as indicator.

Titrate it with 0.025 $Na_2S_2O_3$ solutions. Record the end point, when the blue color of starch disappears.

Calculation:

V_1.0.1.1000/200

Where, V_1=A-B, A=Pre burette no.

B=post burette no.

3. Results and Discussion:

Hemmat River is passing out near Pedhavada village and many other villages in Kodinar Taluka, Gir-Somnath District. We carry out four month study (pre, Middle and post winter Analysis) of River check dam water by performing Physico-chemical and Plankton Analysis. Water collected from check dam of Hemmat River around under 2 fit. Physicochemical Analysis we included 9 parameters like Temperature, PH, Conductivity, T.S, T.D.S., D.O., B.O.D., water Hardness and chloride .Winter time temperature of river water in range 26.7 ^{0}C to 28.1^{0}C. PH range of river water is 7.2 to 9. 1. Higher pH value of river water noted on Jan-16 Month. After recorded results on pH of Hemmat river water indicate some salts concentration higher compare to normal water (fig 1) and Conductivity of water range between 121.2 To 170.1 µmho/cm higher conductivity values indicate salts concentration is higher in water sample. (fig: 2) Dissolved oxygen (D.O) and Biological oxygen demand (B.O.D) data indicated that dissolve oxygen level range 1.20 to 2.7 mg/lit in check dam water. Lover D.O. value indicates very poor condition for aquatic life inside the water (fig 4 & fig 5). T.S. and T.D.S. data of water samples are higher and fluctuated during time period of Analysis. T.S .range of sample 1431 to 2580, Higher, TDS of samples range 570 to 805 mg/lit the data of T.S and T.D.S is higher than normal range its indicated water is not directly use for Agriculture and drinking purpose, Higher values is also dangerous for normal aquatic life. (fig 3) Water hardness is last parameter which concludes that salts quality in water samples like carbonate and many other salts in water sample is higher, Water hardness

Range 145 to 510.0 mg/lit (fig 6) Plankton analysis during time period we isolated 15 spp. of Phytoplankton from Hemmat River water. After completed analysis Ditom ware more numbers compare to other groups, we studied 12 spp. of ditoms in 2 class, 2 phylum,8 order and 8 Families and above from *Coscinodiscus Centralis* and *Thalassionema nitzschioides* found more during all sampling time period. Cynobacteria also found more during analysis of river water. We calculated quantitative evaluation of all groups and prepared systematic classification of phytoplankton in river water. (Table: 03 &04) Our survey on plankton diversity and physiological property we submitted this report to Nagar palika of kodinar city.

Table 1: Physico-chemical analysis data

Date	**10/12/15**		**09/01/16**		**16/01/16**		**09/02/16**	
Location	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Time	09:40 AM.	10:02 A.M	12:15 PM.	12:30 PM.	10:15 AM.	10:20 PM.	05:45 PM.	06:00 PM.
Temperature	26.7'C	27.0 C	27.8'C	28C	28.5'C	27.8C	28.1' C	28.5C
Color	clear	clear	Turbid	turbid	clear	turbid	Clear	clear
Order	smelly	smelly	Smelly	-	smelly	smelly	Smelly	-
pH	8.67	7.8	7.2	8.4	9.1	8.7	8.76	8.5
Conductivity	121.2	135.1	126.7	121.7	143.5	147.4	169.8	170.1
T.S.	1431 mg/lit	1525 mg/lit	2580 mg/lit	2430 mg/lit	2015 mg/lit	2112 mg/lit	1520 mg/lit	14,50 mg/lit
T.D.S.	755 mg/lit	765 mg/lit	615 mg/lit	650 mg/lit	570 mg/lit	575 mg/lit	780 mg/lit	805 mg/lit
D.O.	2.6 mg/lit	2.4 mg/lit	2.7 mg/lit	2.01 mg/lit	1.55 mg/lit	1.20 mg/lit	1.30 mg/lit	1.20 mg/lit
B.O.D.	0.6 mg/lit	0.7 mg/lit	0.8 mg/lit	0.6 mg/lit	0.4 mg/lit	0.51 mg/lit	0.3 mg/lit	0.21 mg/lit
Water Hardness	152 mg/lit	145 mg/lit	178 mg/lit	171 mg/lit	510 mg/lit	450 mg/lit	261.63 mg/lit	321.0 mg/lit
Chloride	84.47 mg/lit	79.2 mg/lit	27.79 mg/lit	32.1 mg/lit	45.94 mg/lit	43.25 mg/lit	63.96 mg/lit	50.12 mg/lit

Table 2: Phytoplankton variation during sampling time period

Hemmat River (10/12/15)	**Sampling Station**	**Abundance in units observed/liter**	**No. of species observed/total species**	**% of Diversity**
	1	48	9/15	60.00
	2	60	12/15	80.00

Hemmat River (09/01/16)	**Sampling Station**	**Abundance in units observed/liter**	**No. of species observed/total species**	**% of Diversity**
	1	36	8/15	53.33
	2	59	10/15	66.66
Hemmat River (16/01/16)	**Sampling Station**	**Abundance in units observed/liter**	**No. of species observed/total species**	**% of Diversity**
	1	86	13/15	86.66
	2	70	12/15	80.00

Hemmat River (09/02/16)	**Sampling Station**	**Abundance in units observed/liter**	**No. of species observed/total species**	**% of Diversity**
	1	48	11/15	73.33
	2	65	14/15	93.33

Table 3: Quantitative Evaluation of phytoplankton in Singoda River water during winter study:

No	Name of species	Abundance in no./li of Hemmat river at two station		Representation by group and induvilual genus/species			
	Diatoms	**1**	**2**	**Total**	**AVG**	**% of group**	**% total**
1	*Synrdra sp.*	9	7	16	8	7.2	6.2
2	*Bacillaria paxillifer*	8	5	13	6.5	5.8	5.0
3	*Leptocylindrus danicus*	5	7	12	6	5.4	4.6
4	*Coscinodiscus centrails*	10	13	23	11.5	10.4	8.9
5	*Rhizosolenia setigera*	10	9	19	8.5	8.59	7.5
6	*Rhizosolenia stolterfothii*	11	8	19	8.5	8.59	7.5
7	*Prorocentrum scutellum*	10	9	19	8.5	8.59	7.5
8	*Thalassionema nitzschioides*	12	8	20	10	9.04	7.7
9	*Navicula sp.*	7	9	16	8	7.2	6.2
10	*Chaetoceros messanensis*	8	10	18	9	8.4	7.00
11	*Pseduonitzchia pungens*	8	9	17	8.5	7.6	6.6
12	*Pleurosigma sp.*	9	10	19	8.5	8.59	7.3
	Total/lit	**108**	**106**	**221**	**18.4**	100	85.99
	Dino flagellates						
1	*Prorocentrum sp*	7	9	15	15	100	5.8
	Total/lit	**7**	**9**	**15**	**15**	**100**	**5.8**
	Cynobacteria						
1	*Trichodesmium erythraeum*	5	7	12	6.0	44.44	4.6
2.	*Microcystis spp.*	8	7	15	7.5	55.55	5.8
	Total/lit	**13**	**14**	**27**	13.5	100	10.50
	Total phytoplankton	**128**	**129**	**257**	**17.13**	**100**	**100**

Table 4: Systematic Account of phytoplankton in Hemmat river ,

	Phylum	Class	Oder	Family	Spieces
Ditoms	Ochrophyta	Bacillariophyceae	Coscinodiscales	Coseinodiscaceae	*Coscinodiscus Centralis*
			Rhizosoleniales	Rhizosoleniaceae	*Rhizosolenia Stolterfothii*
					Rhizosolenia Setigera
			Centrales	Chaetocerotaceae	*Chaetoceros Messanensis*
			Naviculales	Pleurosigmataceae	*Pleurosigma*
				Naviculaceae	*Navicula Spp.*
			Fragilariales	Fragilariaceae	*Synedra Spp.*
			Thalassionematales	Thalasionemataceae	*Thalassionema Nitzschiodes*
			Bacillariales	Bacillariaceae	*Pseduonitzscia Punges*
					Bacillaria Paxillifer
			Leptocylindrales	Leptocylindraceae	*Leptocylindrus danicus*
	Myzozoa	Peridinea	Prorocentria	Prorocentraceae	*Prorocentrum Scutellum*
Dino Flagellates	Pyrrophyta	Dinophyceae	Procentrales	Prorocentraceae	*Prorocentrum Spp*
Cyanobacteria	Cyanobacteria	Cyanophyceae	Oscillatoriales	Phormidiaceae	*Trichodesmium Ergthraeum*
			Chroococaales	Microcystaceae	*Microcystis Spp.*

Fig.1 Analysis of PH of collected river water

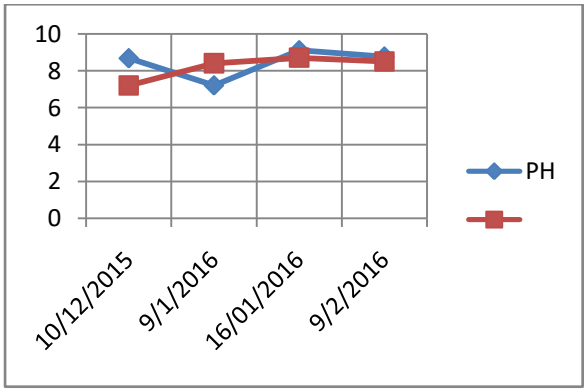


Fig. 2 Analysis of Conductivity of collected river water

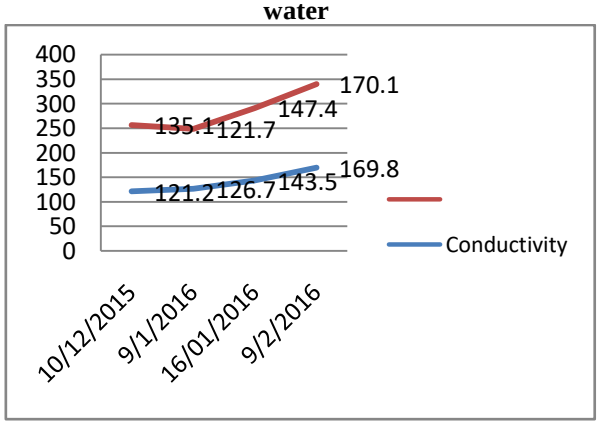
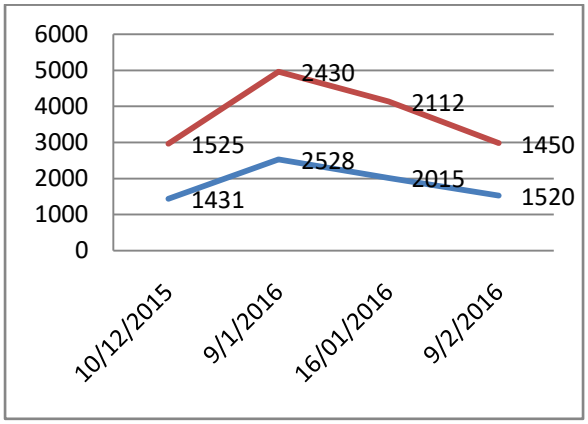


Fig.3 Analysis of T.S and T.D.S of collected river water (mg/Lit)



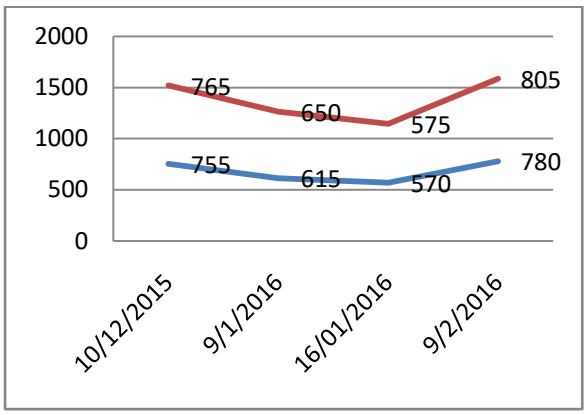


Fig.4 Analysis D.O of collected river water

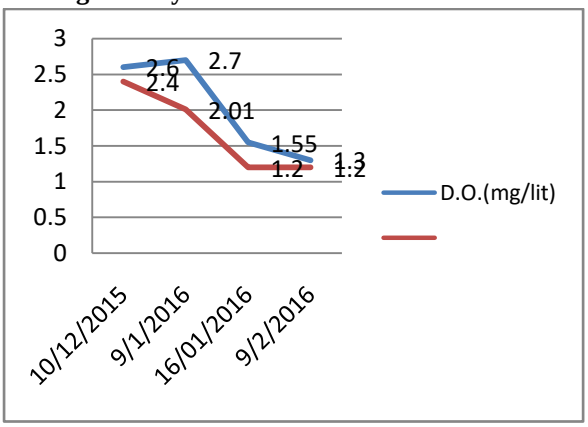


Fig.5 Analysis of B.O.D of collected river water

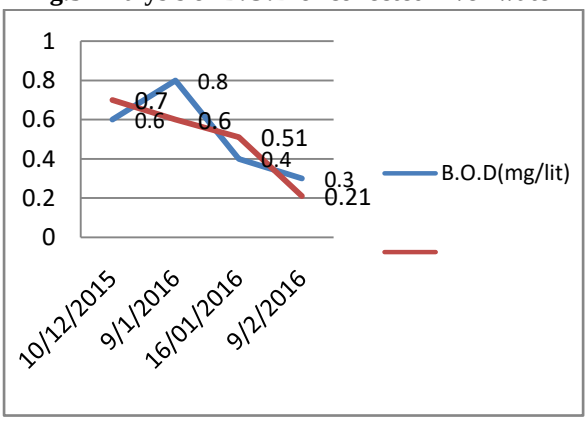


Fig. 6 Analysis of Water Hardness of collected water

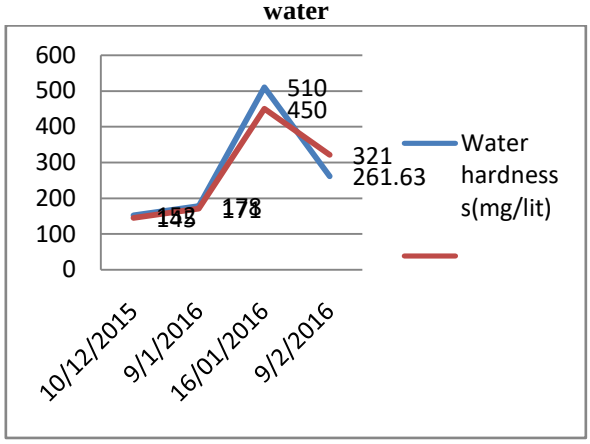
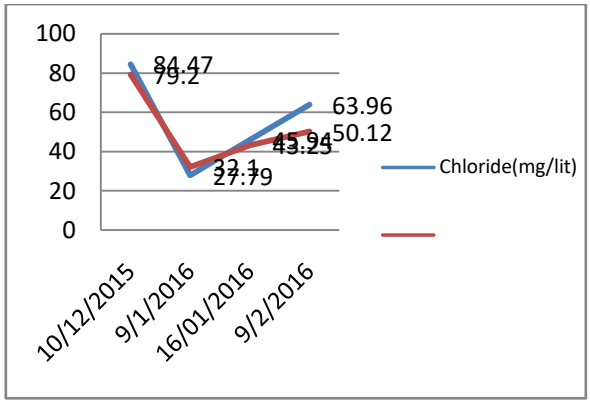


Fig.7 Analysis chloride of collected river water



4. Conclusion

Hemmat River is important River of Kodinar talukas in Gir-somnath district. Gujarat, river water is use for many purpose as in agriculture or aquaculture and also use as potable water in some areas, during study of physicochemical Para-meter we noticed that salt concentration to higher and pH become alkaline during different sampling time period that is not good for water physical and biological property. If we use this water for Agricultural/aquaculture purpose we need special treatment to river water due that negative impact is overcome.

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