

Impact of Industrial Effluent on Physico-Chemical Characteristics of River Basanter Samba (J&K)

Rahul Chandan¹, Manchand Singh², Deepali Kulkarni³, Dr. Vidula Sohoni⁴

P.G. Student, Department of Civil Engineering, BVDU Engineering College, Pune, Maharashtra, India¹

P.G. Student, Department of Civil Engineering, BVDU Engineering College, Pune, Maharashtra, India²

Associate Professor, Department of Civil Engineering, BVDU Engineering College, Pune, Maharashtra, India³

Professor, Department of Civil Engineering, BVDU Engineering College, Pune, Maharashtra, India⁴

ABSTRACT: With increasing population the need of essential things has also increased increasing in demand and thus increasing the need to setup new factories and industries. Rapid industrialization affects the environment in different ways by discharging the large amount of effluent as waste water in the surrounding water bodies, causing the serious problems to environment. [1] In our project five samples were taken two samples were collected from upstream, one at point of mixing of effluent, two samples from downstream of Basantar river and the sample water was characterized for their pollution characteristic. Industrial effluents were studied for four months intervals during Feb 2015-May 2015, however in this paper data is presented for the month of April 2015. In all 20 parameters were studied. These includes Turbidity, Total Suspended Solid, TDS, pH, CO₃, HCO₃, Total Alkalinity CaCO₃, Calcium as CaCO₃, Magnesium as CaCO₃, Sodium, Potassium, Total Hardness, Nitrate-N, Nitrite-N, Phosphate, Chloride, Sulphate, DO, BOD, COD. [2] The pollution levels from these industries were found to be very high and alarming and hence proper care must be taken for the treatment of these effluents before they are discharged to the river. Many big industries have their own effluent treatment plants, but small scale industries are not following the guidelines prescribed for the industrial effluents. The study has shown that almost all the parameters are on the higher levels than the prescribed limit and hence proper treatment methods are needed.

KEYWORDS: Physicochemical Properties, River Basantar, WHO, Samba, Dissolve Solids

I. INTRODUCTION

The most important source of all kind of life on the planet Earth is WATER, but it is being adversely affected both quantitatively and qualitatively by humans. Today most of the rivers receive millions liter of industrial effluents containing varying in characteristics from simple nutrient to highly toxic substances. In recent years, increasing industrialization, urbanization and developmental activities with the population explosion leads to generation of large amount of waste water from domestic, commercial, industrial and other sources. Industrial waste waters directly discharged in to river, lake, nallas, and khadi and created new pollution problem. Industrial pollution is found in large amount in some industrial areas. The pollution level of each effluent is compared with the guidelines as prescribed by WHO and Indian Standard Institution. Industrial Growth Centre Adversely affect the Basantar River which then effects the various life's i.e. both aquatic and terrestrial The Agriculture also receives a lot of setback due to pollution in Basantar River. There was a time when the Samba is known for its vegetation, vegetables and crops were exported from Samba to its neighbouring areas and also to other States. But now Unfortunately due to unbalanced and unplanned Industrialization in Samba the Vegetables and fodder was imported for the Survival of life in Samba. During our sampling duration, we have found dead fishes on the bank of Basantar River. An attempt has been made to study the

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

physic-chemical characteristics of river Basantar that gets polluted because of industries located on its bank. No previous studies have been done on impact of industrial water pollution on Samba region.[3-5]

II. STUDY AREA

Jammu & Kashmir is one of the largest state of India, has Jammu in winter and Srinagar in summer as its Capital. The state economy mainly depends upon agriculture and government Jobs. Jammu & Kashmir has 22 districts. Jammu & Kashmir is situated at 33.20' to 34.15' North Latitude and 74.30' to 75.35' East Longitude and Samba District is located at 32.46' to 32.75' latitude and 74.90' to 75.26' longitude better known as one of the bustling district of Jammu Province, Samba has a very old origin. District Samba lies on south-western part of the J&K State and falls on survey of India top sheet 43 P/L. Samba town is situated on range of Shivalik hills alongside the Jammu-Pathankote National Highway 1A (NH 1A) on the bank of river Basantar at a distance and at 40 km from Jammu city. District Samba is bound by District Udhampur in the North, District Kathua in the East, Tehsils Jammu and Bishnah of District Jammu in the west, while on the southern side it has International Border with Pakistan. The Samba Industrial area is situated at 32.55' to 32.58' latitude and 75.09' to 75.12' longitude on the bank of River Basantar. Basantar River, an important tributary of the river Ravi, originates near Kharai Dhar at an altitude of 1300 m above MSL and flows from southern slopes of Bani. The catchment area is 630sq.km., has maximum discharge during monsoon season. Downstream river flows through series of shallow gorges and has produced asymmetrical valleys from it's source to ChakChavalan, the river passes through deeply carved channel and downstream area i.e. after Nud, the valley widens out and makes a knee bend before entering

Flood plains in Samba and finally joins in Pakistan.[6-7]

The location map of study area is shown in the figure 1.

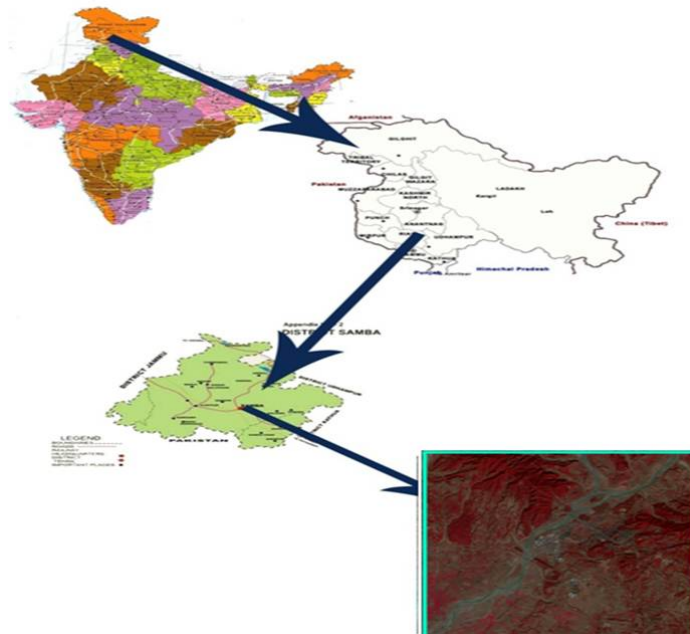


Figure 1 Location of Study Area

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

III. SAMPLING

River Basantar was studied for four months intervals during Feb 2015 - May 2015. However we have represented data for April in this paper. The River Sample is collected for the physico-chemical analysis. The sampling and analysis of industrial effluents require greater care and attention. Considering the above mentioned points, the collected samples were not only representative but also homogeneous and quite sufficient to provide required data. Samplings of industrial effluents were carried out in previously dried glass bottle containers of 3 liters capacity. Sample water is taken from the station at a depth of about 12-22 cm from the surface. A total of 5 samples were collected from five different stations during the period of Feb 2015- May 2015, upstream 0.5 km Above Basanter Bridge, near Chichi Mata (station 1 and 2) and downstream, Below Railway Bridge @0.5 km downstream from mixing point, 4th sample is taken @ 1km downstream from mixing point, last sample is taken @ 1.5 km downstream from mixing point (station 3 to 5). Sampling is done in an interval of 7 days continuously for the months. Every sample was labelled appropriately and brought back to the laboratory for the psychochemical analysis.[8]

IV. EXPERIMENTAL RESULTS

The present study was carried out to find the physico- chemical characteristics during a period of four months from Feb 2015- May 2015, however in this paper; data is presented for the month of April 2015. Overall all the parameters were found on the higher side and the pollution levels and hence proper treatment methods are advised before the industrial effluents are discharged to river.

1. TURBIDITY :

It measures the water clarity and is due to suspended solid particles like clay, silt, colloidal organic matter, planktons, and other organisms. It is also an important parameter, which influences the light penetration into water. It is because of colloidal or finely divided suspended matter in the water which does not readily settle down. Turbidity depends on the nature of the water bodies such as river under flood conditions, lake or other water existing under relatively quiescent conditions, wherein, most of the turbidity is due to colloidal and extremely fine dispersions. The turbidity of Basantar at all the stations were found above desirable limit of 5 NTU. Above 5 NTU water acceptability decreases. The increase in turbidity due to mixing of effluent at station number 3 is shown in figure 2.

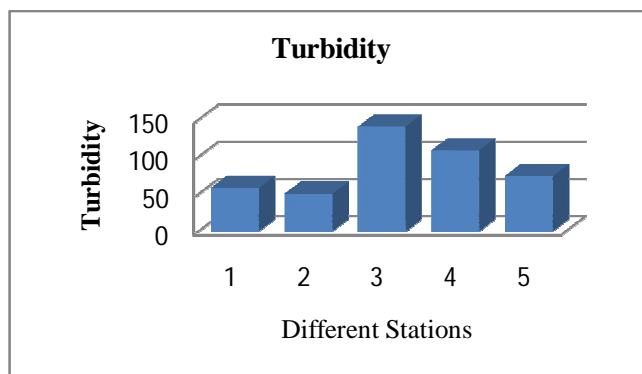


Figure 2: Showing increase in turbidity due to Effluent

2. pH

Most of the chemical and biochemical reactions are influenced by the pH, it is of great practical importance. The adverse effects of most of the acids appear below pH 5 and of alkalis above pH 9.5. The pH values of the Basantar

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

River were found between 7.74 to 8.16 .pH range of 6.5–8.5 is suitable for drinking purpose (WHO 2006 and BIS 2012) and Basanter River values were found within permissible standard limit. Lower pH tends to make water corrosive and higher pH gives negative impact on skin.

3. TOTAL SUSPENDED SOLID (TSS)

These are may be organic or inorganic and include soil, mineral partials from the land by storm and flood water. Suspended solids settle down on the bed of the water bodies changes its properties and affect the fauna and flora. The TSS in the Basanter River is in the range of 86.98 – 352.01 mg/l. According to BIS Tolerance Limit for TSS is 100 mg/l. This value is found higher than limit in Basantar River. The increase in TSS due to effluent mixing is shown graphically in figure 3.

4. TOTAL DISSOLVED SOLID (TDS)

The TDS in the River Basanter are in the range of 209.53 mg/L to 397.45 mg/l. Water containing more than 500 mg/l of TDS causes gastrointestinal irritation. TDS more high value influences the taste, hardness and corrosive property of the water. Water with high TDS is of poor portability and may cause an unfavourable physiological response in the consumer's body. These values are with in permissible limit according to BIS. Due to effluent mixing TDS increase at station 3 and is shown graphically in figure 3.

5. TOTAL HARDNESS (TH)

It is very important parameter in case of water quality for domestic and industrial applications. Hardness in river water is mainly due to divalent cations like Ca^{++} , Mg^{++} , Sr^{++} , Fe^{++} and Mn^{++} which may be found in the combination with various anions like CO_3^{--} , HCO_3^- , SO_4^- , Cl^- , NO_3^- , SiO_3^{--} etc. (Garnaik, 2013). Though hardness has no direct impact on health but it may cause scaling in the pipes .TH of the river water fluctuates from 144.78 – 279.83 mg/l . TH is within the desirable limit of 300mg/l according to BIS. Hardness values are shown graphically in figure 3.

6. CALCIUM AND MAGNESIUM (Ca AND Mg)

Calcium and magnesium are the most common elements in the natural surface and groundwater in the form bicarbonates and to a lesser degree in the form of sulfate and chloride. Calcium is one of the most abundant substances in natural water and comes from leaching of calcium rich rocks such as lime stone or mineralization of organic matter by bacteria. This is a reason that Ca in natural water varies according to difference in geographic regions or anthropogenic activities. In natural water quantity of Ca generally varies from 10 to 100 mg/l depending on the type of rocks. Magnesium generally occurs in all kinds of natural water bodies with calcium, but the concentration remains generally lower than that of calcium. The values of Ca in Basantar River found varying from 135.01-215.74 mg/l. This value is found above desirable limit of 75 mg/l.

Magnesium occurs in all kinds of natural water with calcium, but the concentration remains generally lower than that of calcium. Similarly, magnesium varies from 8.83-47.13 mg/l. It is found little above the desirable limit.

7. TOTAL ALKALINITY

It is due to the presence of carbonates, bicarbonates and hydroxide constituents in water, which may be derived from dissolved rocks, salts or sediments. It is a measure of the ability of water to neutralize acids. High alkalinity in water, harmful for irrigation as it damages soil and hence reduces crop. Total alkalinity in River Basanter ranges from 213.29 – 354.69 mg/l. Presence high values of TA in river water might be due to agricultural and domestic waste discharges that can cause accumulation of fatty acids, propionates, acetates etc. Its value is above the desirable limit of 200mg/l but within the permissible limit of 600 mg/l.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

The increase in alkalinity values are shown in figure 3.

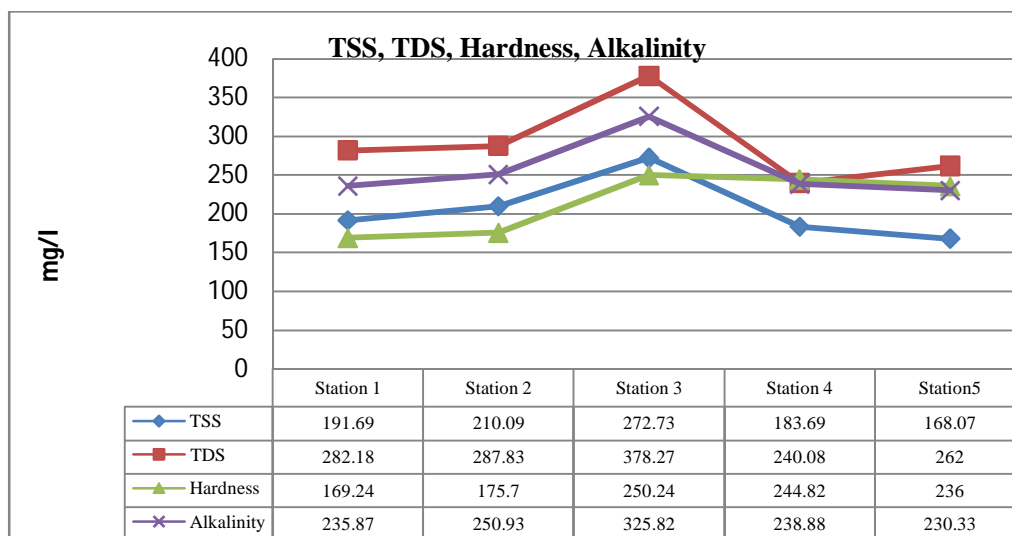


Figure 3 Showing TSS, TDS, Hardness, Alkalinity at different Stations

8. SODIUM :

Sodium values in the Basanter water ranges from 23.13- 46.92 mg/l respectively.

9. CHLORIDES:

Chloride is one of the major inorganic anions in water and waste water. The chloride ion is the predominate natural form of the element chlorine and is highly stable in the water. Chloride contents of water in the river vary from 20.36--27.59 mg/l. The value of Chlorides for river Basantar is within the desirable limit.

10. CARBONATE AND BICARBONATES:

There are most significant chemical system in natural waters. The carbonate is derived from carbonate weathering and bicarbonate derived from silicate weathering. The Carbonate (CO_3^{2-}) values range from 11.84-26.72 mg/l and similarly, value of HCO_3^- ranged from 186.64-331.03 mg/l. These values are within permissible limit.

11. NITRATE AND NITRITE:

The concentration of NO_2^- varies in the ranges 0.02-0.18. The presence of nitrite in the environment means biological activities and even a small amount of nitrite indicates the beginning of pollution. Nitrite presence is also related to DO and decrease in DO causes the microbiological reduction of nitrate to nitrite. The nitrate concentration ranges from 0.048-0.76 mg/l. Variation in nitrate contents of Rivers Basanter may be due to the nitrate released from fertilizers, which are not absorbed by soils but washed off from the land during flows. Besides nitrate may also be added in the environment because of agricultural activities, waste water carrying human and animal excrete. These values are within permissible limit according to BIS.

12. PHOSPHATE:

It is an essential nutrient for plants and animals. The concentration of phosphate in river water ranges from 0.43-0.89 mg/l. 2 mg/l of phosphate is suitable for aquatic life and drinking purpose.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

13. SULPHATE:

It naturally occurs in the environment and can be in high concentrations. Sulphate contamination in water can emerge from soil and industrial effluents. The presence of Sulphate in drinking-water can cause taste problems and very high amount of Sulphate can result to bowel problems in human. Sulphate values of river water vary from 19.77- 32.28 mg/l . These Values are found with limit according to BIS.

14. DISSOLVED OXYGEN (DO):

It is an essential parameter for the survival of aquatic life and also a control parameter for the pollution of water. The domestic wastewaters, which are rich in phosphate and nitrate discharge into surface waters, the growth of aquatic plants may become fast and the amount of dissolved oxygen decreases. The DO content in the river water samples showed marked variations at different stations. It ranged from 2.7 – 7.84 mg/l .High values of DO provide river water with natural self-purification capacity. The standard for DO in good quality streams is usually more than 5 mg/l to promote proper growth of fish and other aquatic organisms . The high concentrations of DO are observed at upstream (stations 1 and 2) and downstream (stations 5). High concentrations of DO in river water indicate high aeration rate and rapid aerobic oxidation of biological substances. The low concentration of DO observed at stations 3 and 4 which are recipient of industrial waste water. The decrease in dissolved oxygen is shown graphically in figure 4.

15. BIOLOGICAL OXYGEN DEMAND (BOD):

It is an important parameter for water quality and represents the oxygen demanding capacity of organic materials. It is the quantity of oxygen required by bacteria while stabilizing decomposable organic matter under aerobic conditions. The biodegradation of organic materials exerts oxygen tension in the water and increases the biochemical oxygen demand. Increase in BOD concentration may cause the death of some aquatic organisms such as fish and increase eutrophication .So, this test is required for assessing the pollution of surface water, polluted due to disposal of industrial effluents. It is evident that water which has DO value higher than 8 mg/l and BOD value less than 3 mg/l, shows high quality in terms of these two parameters. In our sampling upstream stations from Station 01 and Station 02 shows low BOD values and downstream from Station 03 to 05 shows high concentrations of BOD due to mixing of effluent at station 03. The observed values of BOD ranged from 0.35-13.41 mg/l. Due to the effluent mixing at station 3 BOD of water increases and this increase is shown graphically in figure 4.

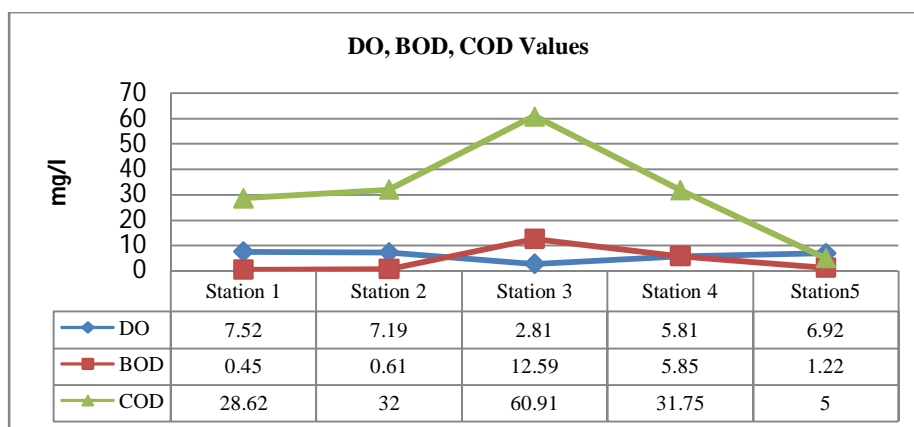


Figure 4 Showing DO, BOD, COD values at different Stations

16. CHEMICAL OXYGEN DEMAND (COD):

It is chemical oxidation of most organic matters and oxidisable inorganic substances with the help of strong chemical oxidants. In conjunction with the BOD, the COD test is helpful in indicating toxic conditions and the presence of biologically resistant organic substances. The COD values ranges from 26.46-62.93 mg/l. Higher concentrations of COD indicated that organic and inorganic

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

matter is present in river water both suspended and dissolved form that has even raised the TDS and TSS of fresh water samples of the river

So, BOD and COD are two common parameters for measures of water quality that reflect the degree of organic pollution of the water bodies when their concentrations are higher than 5 and 10 mg/l, respectively (WHO). [9-10]. The COD of river water increases at effluent mixing and is shown in figure 4.

The values of the above parameters at different stations are given in chart 1

V. CONCLUSION

The present study shows that the Basantar River is carrying industrial waste from Industrial Growth Centre Samba. At many places, the water is highly polluted. The polluted areas with heavy influx of organic and innumerable industrial waste has drastically reduced the biodiversity in city area and downstream of river. This is due to absence of presence of treatment of effluent before discharging the effluent to Basantar River.

Further studies are needed to improve the water quality and lead remedial measure. There is a need to have proper collection and treatment of waste.

REFERENCES

- [1] Sharma M R, J Pollut Res, 2004, vol. 23(1), page131-134.
- [2] Umaran P and RamuA., "Assessment of Groundwater quality of East Coast Region in Tamilnadu, India", International Journal of Research in Chemistry and Environment". Vol.5 issue 4 (80-90) Oct 2015
- [3] A.Agarwal, and M.Saxena, "Assessment of pollution by physicochemical water parameters", Advanced applied science research 2011, vol. 2 (2) : page 185-189.
- [4] Kumar A, Water Pollution. Nisha Enterprises New Delhi. 2004, pp 1-331.
- [5] APHA, Standard methods for the examination of water and waste water, American Public Health Association, Washington, 1989
- [6] Central Ground Water Board Ministry of Water Resources Govt. of India. Annula Report 2009-2011. Page 7 & Page 9.
- [7] <https://en.wikipedia.org/wiki/Effluent>
- [8] Clescerl, L.S., A.E. Greenberg and A.D. Eaton, (1993), Standard Methods of Examination of Water and Waste Water. 18th Edn., American Public Health Association, USA., pp 2340.
- [9] Environmental Engineering By GN PANDEY & GC CARNEY
Sewage Disposal By SANTOSH KUMAR GARG

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

S. No.	Parameters	Station-01	Station-02	Station-03	Station-04	Station-05
01	Turbidity (NTU)	58.58±31.56	50.65±26.34	140.83±36.25	109±50.39	74.52
02	Total Suspended Solids (mg/l)	191.69±82.20	210.09±88.27	272.73±79.28	183.69±72.16	168.07±81.09
03	TDS (mg/l)	282.18±16.67	287.83±15.26	376.27±21.18	240.08±30.55	262±8.16
04	pH	7.87±0.13	8.09±0.05	7.85±0.15	7.83±0.10	8.10±.06
05	CO ₃	13.29±0.58	12.08±0.24	23.58±3.14	19.84±2.2.7	17.06±2.14
06	HCO ₃	218.5±10.22	209.21±11.74	308.88±22.15	208.18±21.52	204.75±7.14
07	Total Alkalinity CaCO ₃ (mg/l)	235.87±15.9	250.93±13.35	325.82±28.87	238.88±18.95	230.33±17.04
08	Calcium as CaCO ₃ (mg/l)	171.88±7.82	141.51±6.50	196.86±18.88	184.37±16.88	185.17±5.40
09	Magnesium as CaCO ₃ (mg/l)	35.37±5.30	30.50±1.91	40.28±6.85	10.33±0.02	11.13±2.30
10	Sodium (mg/l)	38.63±8.29	27.41±4.28	28.87±3.81	30.53±3.60	30.53±3.33
11	Total Hardness(mg/l)	169.24±24.46	175.70±16.09	250.24±29.59	244.82±28.17	236±27.16
12	Nitrate-N (mg/l)	0.64±0.06	0.66±0.10	0.57±0.05	0.54±0.06	0.53±0.10
13	Phosphate-P(mg/l)	0.58±0.05	0.47±0.09	0.76±0.13	0.62±0.06	0.53±0.1
14	Chloride(mg/l)	23.35±2.89	21.96±1.50	23.68±2.35	24.88±2.59	25.08±1.02
15	Sulphate(mg/l)	22.88±2.28	26.33±1.68	29.15±3.68	20.68±5.50	26.60±2.57
16	DO (mg/l)	7.52±0.32	7-19±0.38	2.81±0.11	5.21±0.29	6.92±0.19
17	BOD (mg/l)	0.45±0.1	0.61±0.12	12.59±0.82	5.85±0.62	1.22±0.11
18	COD (mg/l)	28.62±2.16	32±4.21	60.91±2.02	31.75±3.12	42.98±2.31

Chart 1 Showing Ranges of Various Parameters