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Ganga water quality at Kangri Village, District Haridwar with reference to physico-chemical parameters

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Abstract

In the present investigation water quality monitoring of river Ganga at Kangri village, District Haridwar was studied with reference to physico-chemical parameters during the period January, 2009 to December, 2009. Parameters studied was Temperature, pH, free CO_2, D.O., B.O.D, T.D.S., Acidity, Alkalinity, Hardness, Calcium, Chlorides and Conductivity. Statistical analysis of the analytical data was computed in the table.

Keywords:*Physico chemical parameter, River Ganga, Water quality*

Introduction

Rivers are life line of human settlement but there are natural and anthropogenic factors which influence the water quality of river (Gupta and Chakarpani, 2007). The Ganga river is one of the most sacred river in India. In Kangri village, Ganga river passes through the Haridwar, at Shyampur and GendiKhata villages. Kangri village is situated at the east bank of river Ganga, District Haridwar which is connected through Haridwar-Najibabad road. Due to anthopogenic activites, unproportional growth of population and industries, water quality of river Ganga is degrading at a faster rate day by day therefore, regular monitoring of river Ganga is essential.With this aim, various studied have been conducted in the past on fresh waters related to various aspects. In the present investigation physicochemical parameter of river Ganga at Kangri village was done.

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Material and Methods

Haridwar is one of the most holy cities of India. It lies in the foothills of Shivalik range. The position of city on the globe is on latitude 29º58'N and longitude78 º 13′ E.Watersamples were taken from upstream and downstream of Kangri village in Haridwar district. The selected sites of Upstream and downstream of Kangri village denoted as Sampling site A and sampling site B. Monthly sampling was done from January-2009 to December 2009. Samples were collected between 7.00 a.m. to 9.00 a.m. in borosil glass bottles of 300 ml capacity and plastic containers from each sampling sites. The analysis of all the parameter was done according to the methods of APHA (1998), Khanna and Bhutiani (2004).

Results and Discussion

The monitoring of the river water is a necessary step to mark the trend pattern of pollutants and their effect on living systems in today's developing life. On the basis of analysis average value of various physico-chemical parameters are given in table 1 from sampling site A and B at Kangri village.

Temperature is an important parameter, which is directly related with the chemical reaction in water and biochemical reactions in the living organisms. In the present investigation the maximum

temperature (21.50±0.23) was recorded in May while minimum temperature (15.50± 0.05) in December. Similar results regarding to temperature was also observed by Khanna and Bhutiani (2005), Badola and Singh (1981). pH is one of the important tool to measure acidity or alkalinity in water. Aquatic organisms are sensitive for pH change due to any change in the pH cause change in the structure of aquatic system. In this study, pH observed maximum (8.60±0.05) in the month of July and minimum (7.10±0.00) in the month of February. Similar results regarding to pH was also repoted by Yadav and Kumar (2011) in the river Kosi at Rampur district and Khanna and Bhutiani (2005) in river Ganga. Free CO2 comes in water due to activity of aquatic organism. In the present investigation the value of free CO2 vary from (1.26±0.24) minimum in the month of December to (3.60±0.54) maximum value in the month of July. This is similar findings of Khanna*et al* (2007) in river Ganga. Acidity of water is quantitative capacity to react with a strong base to a designated pH. In the present study the concentration of acidity was found to be fluctuating between (11.00±0.68 to 7.14±0.54). This maximum (11.00±0.40) and minimum (7.14±0.04) concentration of Acidity was observed in the month of August and January respectively. A more or less similar trend has been observed by Rai*et al* (2010) in river Ganga at Varanasi. Alkalinity is due to presence of Carbonate and Bicarbonate ions. Alkalinity of water found to be maximum (156.00±1.15) in the month of July and minimum (100.00±0.01) in the month of March. Khanna*et al* (2007) also reported the similar trend on Song river at Dehradun and Sarkar*et al* (2007) observed similar trend for Alkalinity. Hardness indicates the concentration of calcium and magnesium ions. Hardness of water is due to the presence of chloride, Nitrate, sulphate and bicarbonate of calcium and magnesium. (Kumar et al 2010) The maximum (156.00±1.05) hardness of water observed in the month of August while minimum (98.00±0.65) in month of January. Mishra (2003) observed hardness in river Ganga at Haridwar and found more or less trend in their study and Sarkar*et al* (2007) observed similar trend for hardness. The concentration of Calcium was found to be maximum (49.08±0.25) in the month of March while minimum (28.08±1.06) in the month of April. Similar findings were observed by Khajuria and Dutta (2009) in the river Tawi, Jammu. In natural water sometimes chloride may be due to leaching of rocks. In the present study the concentration of chloride was found to be fluctuating between (38.34±0.91 to 8.78±0.53). This maximum (38.34±0.91) and minimum (8.78±0.53) concentration of chloride was observed in the month of July and November respectively. Similar observation was also observed by Vishnoi*et al* (2008) in river Ganga at Kangri village and U.P. Sharma (1996) also reported the similar trend on Koshi river in Nepal. DO is one of the most important factors, which depends on physical, chemical and biological activities of water body. In the present investigation maximum (11.97±0.56) value of DO was recorded in the month of December while minimum (9.78±0.39) in the month of August. Khanna *et al* (2010) reported the similar trend in river Ganga, Sangum and Sharma (1985) in river Yamuna. Conductivity is the measure of the ability of an aqueous solution to carry electric current. Conductivity of Ganga river water fluctuates from (378.00±5.29 to 177.60±0.49). The concentration of Conductivity was found to be maximum (378.00±5.29) in the month of March while minimum (177.60±0.49) in the month of November. A more or less similar trend has been reported by Bhardwaj *et al* (2010) on ChhotiGandakriver. Total dissolved solids or filterable residue are those solids, which left after evaporation of the filterable sample. TDS indicate the total amount of inorganic chemicals in the solution. In the present study the maximum (382.00±2.30) and minimum (156.00±6.44) concentration of TDS was observed in the month of July and April respectively. Khanna (1993) also observed similar trend for total dissolved solid andVenkatesharaju *et a. l*(2010) in Cauvery river. The biochemical oxygen demand is the amount of oxygen required to degrade the organic compound biologically. The concentration of BOD increases with the increase in chemical pollution of the water body. In the present investigation maximum (3.05±0.53) value of BOD was recorded in the month of July while minimum (0.99±0.23) in the month of November. The similar conclusion was supported by Khanna*et al. (*2007) in river Ganga and Venkatesharaju*etal*(2010) in Cauvery river

Table-1:Average value of physiochemical parameter of river Ganga from January to December 2009

Months	Temp (°C)	pH	CO_2 (mg/l)	Acidity (mg/l)	Alkalinity (mg/l)	Hardness (mg/l)	Calcium (mg/l)	Chloride (mg/l)	DO (mg/l)	Conduc. (µmhos/cm)	TDS (mg/l)	BOD (mg/l)
January	15.50 ±0.25	7.20 ±0.05	1.86 ±0.01	7.14 ±0.54	116.00 ±0.05	98.00 ±0.65	36.08 ±0.05	9.64 ±0.22	11.74 ±0.56	190.80 ±0.46	186.00 ±0.49	1.38 ±0.02
February	17.00 ±0.32	7.10 ±0.00	1.98 ±0.04	8.00 ±0.32	110.00 ±0.49	120.00 ±1.46	42.68 ±0.52	10.00 ±0.30	10.99 ±0.28	187.80 ±1.16	198.00 ±0.56	1.74 ±0.04
March	18.00 ±0.26	7.20 ±0.11	2.08 ±0.05	8.02 ±0.35	100.00 ±0.01	156.00 ±0.99	49.08 ±0.25	10.35 ±0.33	10.45 ±0.26	378.00 ±5.29	205.00 ±0.99	1.88 ±0.06
April	20.00 ±0.28	7.30 ±0.00	2.86 ±0.03	8.50 ±0.28	115.00 ±0.43	140.00 ±1.00	28.08 ±1.06	10.48 ±0.28	10.44 ±0.36	206.80 ±3.71	156.00 ±6.44	1.77 ±0.11
May	21.50 ±0.23	7.30 ±0.15	2.48 ±0.09	9.00 ±0.40	120.00 ±0.51	124.00 ±0.86	38.07 ±0.99	12.45 ±0.02	9.98 ±0.27	168.50 ±7.07	238.00 ±0.51	1.98 ±0.10
June	20.00 ±0.10	8.00 ±0.20	2.68 ±0.35	10.00 ±0.50	115.00 ±0.57	126.00 ±1.52	39.45 ±1.03	29.82 ±0.26	10.08 ±0.30	286.00 ±1.00	246.00 ±1.14	1.86 ±0.06
July	20.50 ±0.23	8.60 ±0.05	3.60 ±0.54	10.05 ±0.72	156.00 ±1.15	148.00 ±4.04	42.68 ±1.64	38.34 ±0.91	9.86 ±0.53	247.60 ±5.89	382.00 ±2.30	3.05 ±0.53
August	18.50 ±0.15	7.50 ±0.15	2.86 ±0.44	11.00 ±0.68	150.00 ±0.56	156.00 ±1.05	43.08 ±0.27	38.05 ±0.53	9.78 ±0.39	238.00 ±0.56	278.00 ±1.14	2.08 ±0.45
September	19.00 ±0.28	7.30 ±0.11	1.98 ±0.01	8.98 ±0.18	144.00 ±0.43	98.50 ±1.00	36.56 ±0.50	10.38 ±0.28	10.86 ±0.22	265.20 ±3.22	180.00 ±1.31	1.02 ±0.48
October	19.50 ±0.23	7.20 ±0.17	2.08 ±0.05	10.74 ±0.06	120.00 ±0.54	130.00 ±1.31	39.98 ±1.60	11.45 ±0.21	10.34 ±0.12	206.00 ±2.89	216.00 ±2.56	1.98 ±0.06
November	18.00 ±0.26	7.60 ±0.05	1.75 ±0.06	9.80 ±0.30	116.00 ±0.17	110.00 ±1.15	40.08 ±0.85	8.78 ±0.53	10.68 ±0.18	177.60 ±0.49	298.00 ±0.58	0.99 ±0.23
December	15.00 ±0.05	7.40 ±0.00	1.26 ±0.24	9.00 ±0.16	120.00 ±0.30	100.00 ±0.56	41.86 ±0.02	9.86 ±0.07	11.97 ±0.56	184.80 ±0.52	292.00 ±0.27	1.86 ±0.07
Average ±Sd	17.26 ±1.97	6.92 ±0.43	2.16 ±0.63	8.56 ±1.16	115.31 ±17.07	117.49 ±21.39	37.13 ±5.06	16.24 ±11.54	9.83 ±0.70	215.16 ±60.00	226.06 ±63.85	1.70 ±0.53

The correlation coefficients among the different parameters are presented in the table-2. The analysis shows high degree positive correlation between temperature and CO_2, temperature and hardness, temperature and acidity, temperature and chloride, temperature and pH, temperature and BOD, temperature and alkalinity, temperature and TDS. pH and TDS, pH and chloride, pH and CO2, pH and BOD, pH and alkalinity, pH and acidity, pH and hardness, pH and conductivity, pH and calcium. CO2 and chloride, CO2 and Hardness, CO_2 and BOD.CO2 and alkalinity, CO2 and acidity, CO_2 and TDS, CO2 and conductivity.

Acidity and chloride, Acidity and alkalinity, Acidity and TDS, Acidity and Hardness Acidity and BOD, Acidity and calcium.Alkalinity and chloride, Alkalinity and TDS Alkalinity andBOD, Alkalinity and hardness.Hardness and BOD, Hardness and chloride, Hardness and conductivity, Hardness and calcium Hardness and TDS.Calcium and conductivity, Calcium and TDS, Calcium and DO, Calcium and BOD, Calcium and chloride. Chloride and BOD, Chloride and TDS, Chloride and conductivity. Conductivity and BOD.TDS and BOD.

The analysis shows the high degree negative correlation between temperature and DO, temperature and conductivity, temperature and calcium. pH and DO. CO_2 and DO, CO_2 and calcium.Acidity and DO, Acidity and conductivity.

Alkalinity and DO, Alkalinity and calcium.Alkalinity and conductivity, Hardness and DO.Calcium and DO.Chloride and DO., DO and BOD, DO and conductivity, DO and TDS.Conductivity and TDS.

Table-2: Correlation between physicochemical parameters during January- December 2009

	Temp.	pH	CO_2	Acidity	Alkalinity	Hardness	Calcium	Chloride	DO	Cond.	TDS	BOD
Temp.	1	0.37	0.73	0.46	0.28	0.48	-0.21	0.37	-0.87	-0.87	0.10	0.37
pH		1	0.66	0.44	0.55	0.27	0.13	0.76	-0.43	0.17	0.79	0.58
CO_2			1	0.38	0.53	0.70	-0.11	0.77	-0.80	0.22	0.32	0.69
Acidity				1	0.55	0.36	0.16	0.62	-0.62	-0.01	0.55	0.34
Alkalinity					1	0.15	-0.01	0.68	-0.35	-0.04	0.52	0.38
Hardness						1	0.33	0.56	-0.76	0.50	0.20	0.66
Calcium							1	0.24	-0.10	0.48	0.44	0.30
Chloride								1	-0.63	0.25	0.62	0.67
DO									1	-0.30	-0.26	-0.49
Cond.										1	-0.07	0.15
TDS											1	0.56
BOD												1

Fig 1-12: Showing monthly fluctuation in physiochemical parameters of river Ganga at Kangri village.

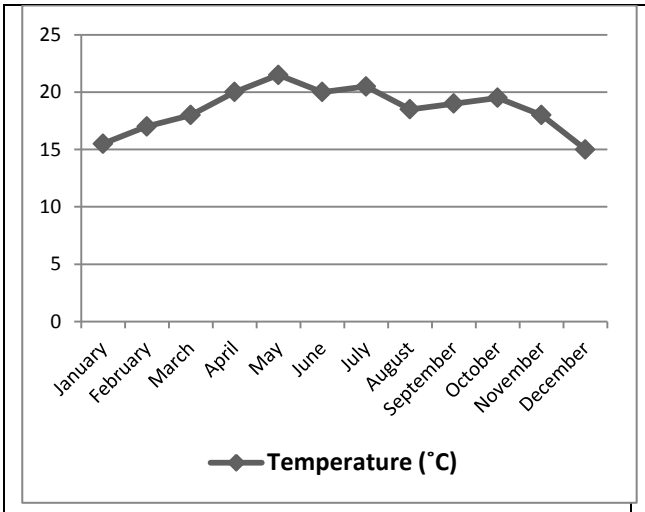

Fig.-1

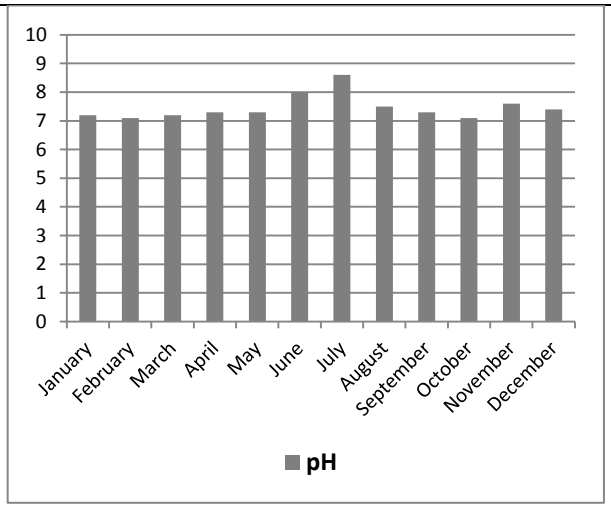

Fig -2

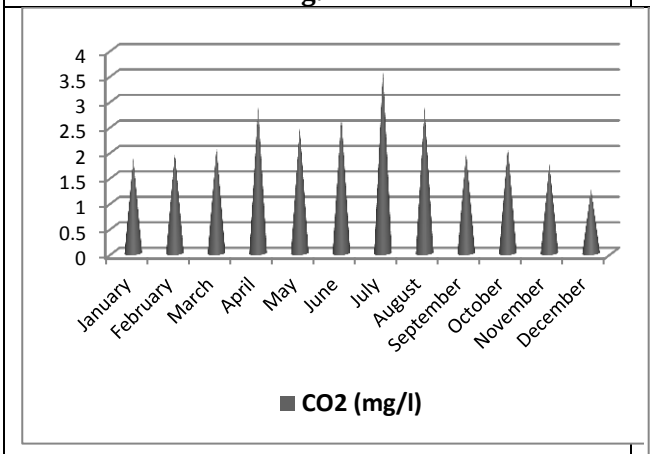

Fig.-3

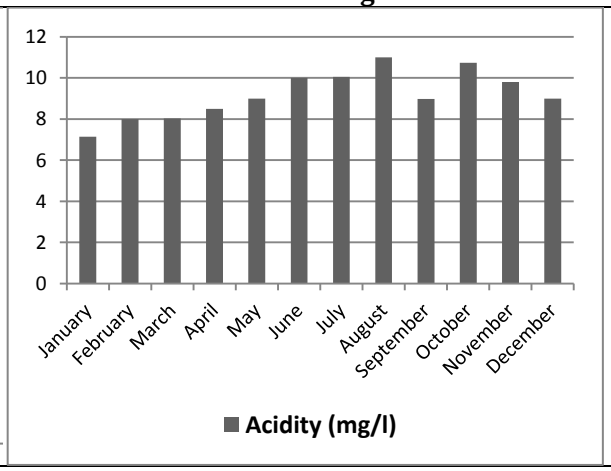

Fig.-4

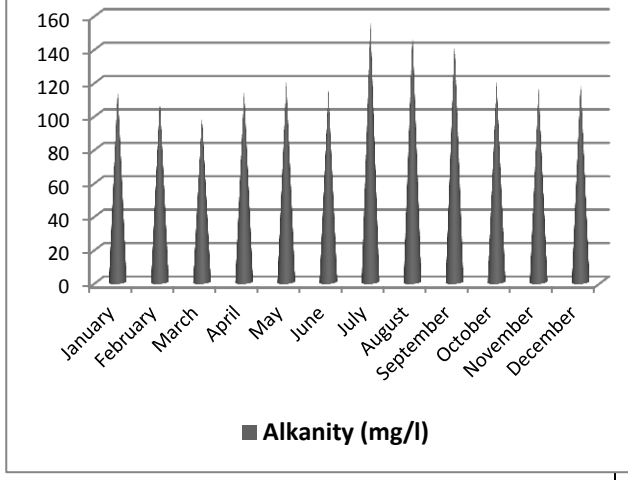

Fig.-5

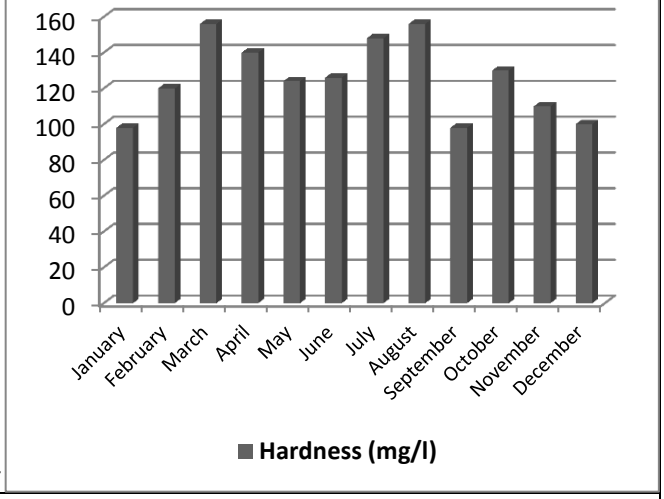

Fig.-6

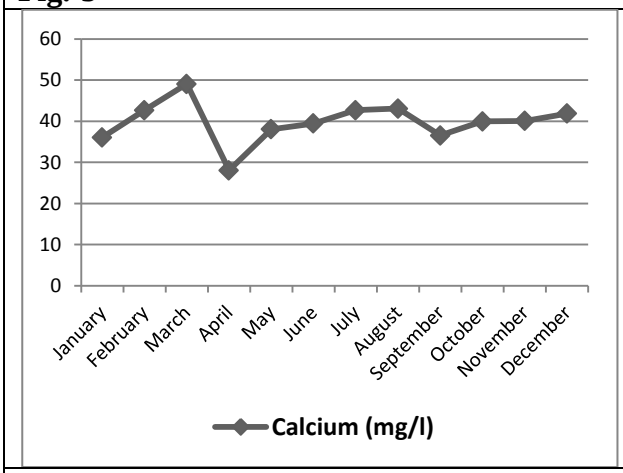

Fig.-7

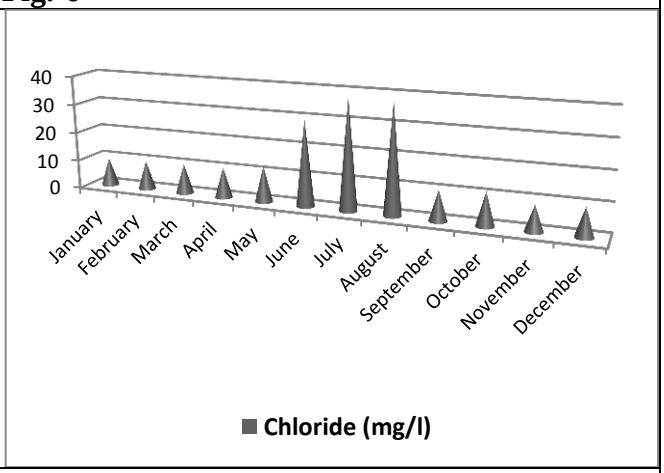

Fig.-8

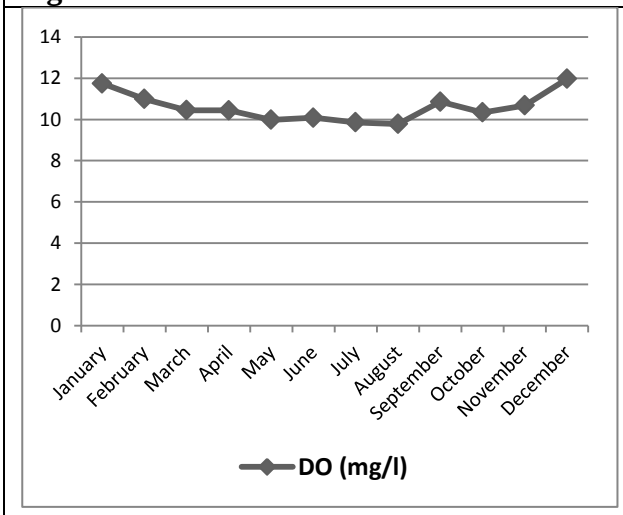

Fig.-9

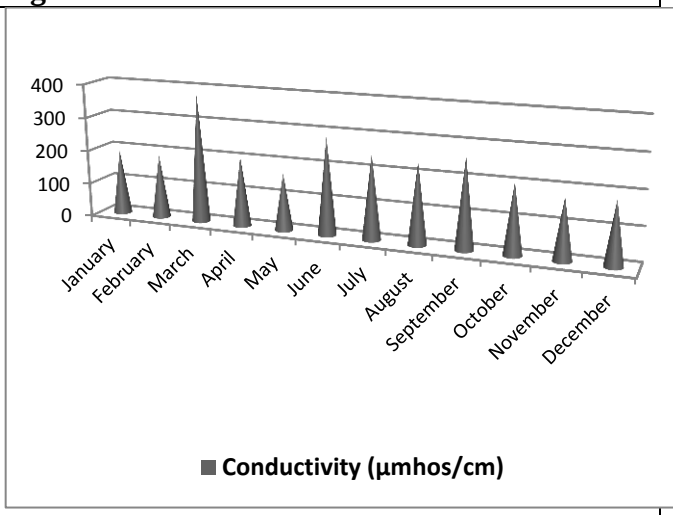

Fig.-10

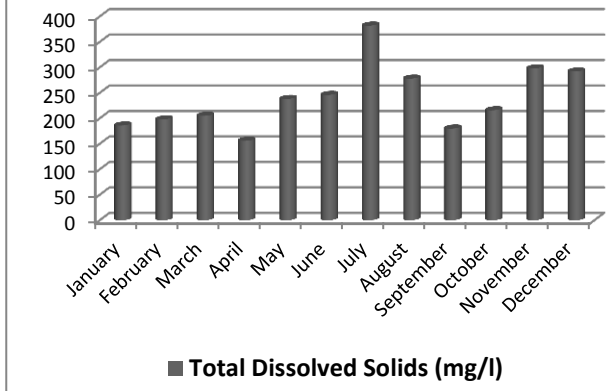

Fig.-11

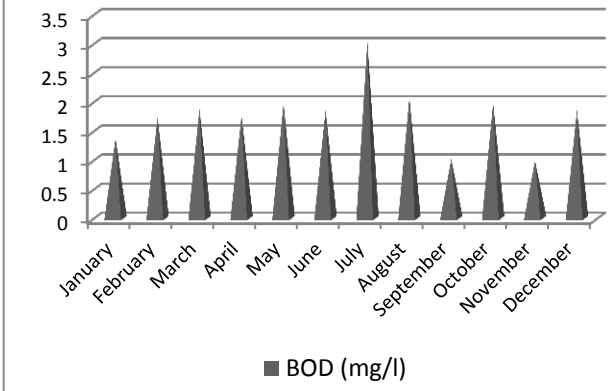

Fig.-12

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