Study of Waste Water Characteristics and its pollution for the stretch of Krishna River from Sangli to Haripur

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Abstract: ***The Sangli city is located at southern part of Maharashtra state in India. The Krishna River enters Sangli city from the northern part and is the main source of water for the domestic, industrial and agriculture purpose of Sangli city. Nearly 55 MLD of water is consumed by the people of Sangli from the Krishna River. Approximately 48 MLD of waste water is generated from Sangli City. The sewerage system as well as treatment facilities provided by municipal authorities have become inadequate due to heavy growth of population. The current sewerage system accounts only for 40-50 % of requirement. The waste water from uncovered sewerage area mixes in natural nallas, which are end into Krishna River. In summer the rate of river water flow is low while the flow of sewage from the nallas in to the river is more which almost results into a sewage drain. The present study is an attempt to study the waste water characteristics and its analysis for the stretch of the Krishna River from Sangli to Haripur.***

Keywords: domestic sewage, sources, characteristics, analysis

1. Introduction

National River Conservation Directorate, New Delhi, has launched the programme of pollution abatement of Krishna river, under Krishna River Action Plan (KRAP) in 1993.This river action plan was prepared to restore Krishna River water quality at Karad and Sangli. The core of this project is collection, treatment and disposal of sewage from Sangli city with a capacity of about 27 MLD. The construction work of various components of this plan is in progress. The distance of the study stretch is approximately 4.1 km. The study highlights the characteristics of river water and waste water, which were analyzed for the parameters such as pH, D.O. BOD, COD and Chlorides. This study was conducted for the period of eight months from September-2008 to April 2009.The frequency of collection of the river water and waste water samples was twice in a month from the monitoring stations. The grab sampling method has been adopted. Monitoring stations selected on the stretch were By -pass bridge, Irwin Bridge, K.T. weir Sangli, at Haripur village. Three nallas were identified in this stretch viz. Sheri nalla, J.J. Maruti Mandir nalla and Haripur nalla respectively. The guidelines published by Central Pollution Control Board in 2007 were followed for the selection of water quality monitoring stations (Trend stations).The methods were followed for the analysis of water and waste water samples as per the American Public Health Association edition 1998. The important factors, affecting river water quality were identified and assessed for various seasons. Based on the findings of the study, suitable measures to restore river water quality and waste water management technique are also suggested. Study area and salient features of water and waste water management in Sangli-Miraj- Kupwad Municipal Corporation, Sangli (Maharashtra). The water consumption of Municipal Corporation is 55 MLD. The waste water generated from corporation area is around 48 MLD. The municipal authority has provided 10 oxidation ponds to treat 12.76 MLD waste water. Treated effluent is partly used for irrigation purpose. Due to urbanization irrigation land is reduced and partly treated / untreated effluent mixing into Krishna river through Sheri Nalla and Haripur Nalla. Presently Sheri Nalla which meets river Krishna is plugged and effluent coming in Sheri Nalla is pumped and disposed at the D/s of K. T. weir Sangli. Maharashtra Jeevan Pradhikaran is the authority has prepared scheme for collection, treatment and disposal of waste water from Sangli city Under National River Conservation Plan for abatement of Krishna river pollution. The sewage treatment plant commissioned at Dhulgaon Tal. Tasgaon Dist. Sangli. Sangli city is divided into 4 zones. Entire sewage collected from these zones will be pumped in two stages to STP at Dhulgaon. The capacity of sewage treatment plant is 27 MLD consisting of Primary treatment unit's viz. Inlet Chamber, Screen Chamber, and Grit Chamber etc. Anaerobic Ponds, Maturation Ponds (5 No.), by pass arrangement and Distribution Chamber. As on today, the implementation work of this plan is in progress. The Municipal Corporation, Grampanchyats located nearby Sangli area do not have adequate collection, treatment and disposal arrangement for waste water. The municipal corporation, Sangli, industries and villages located near Sangli city are consuming Krishna River water for domestic, Industrial and agriculture purposes from Sangli to Haripur stretch. The present study consist of collection of relevant data, selection of sampling stations, flow measurements and characterization of water as well as waste wateras shown in figure.

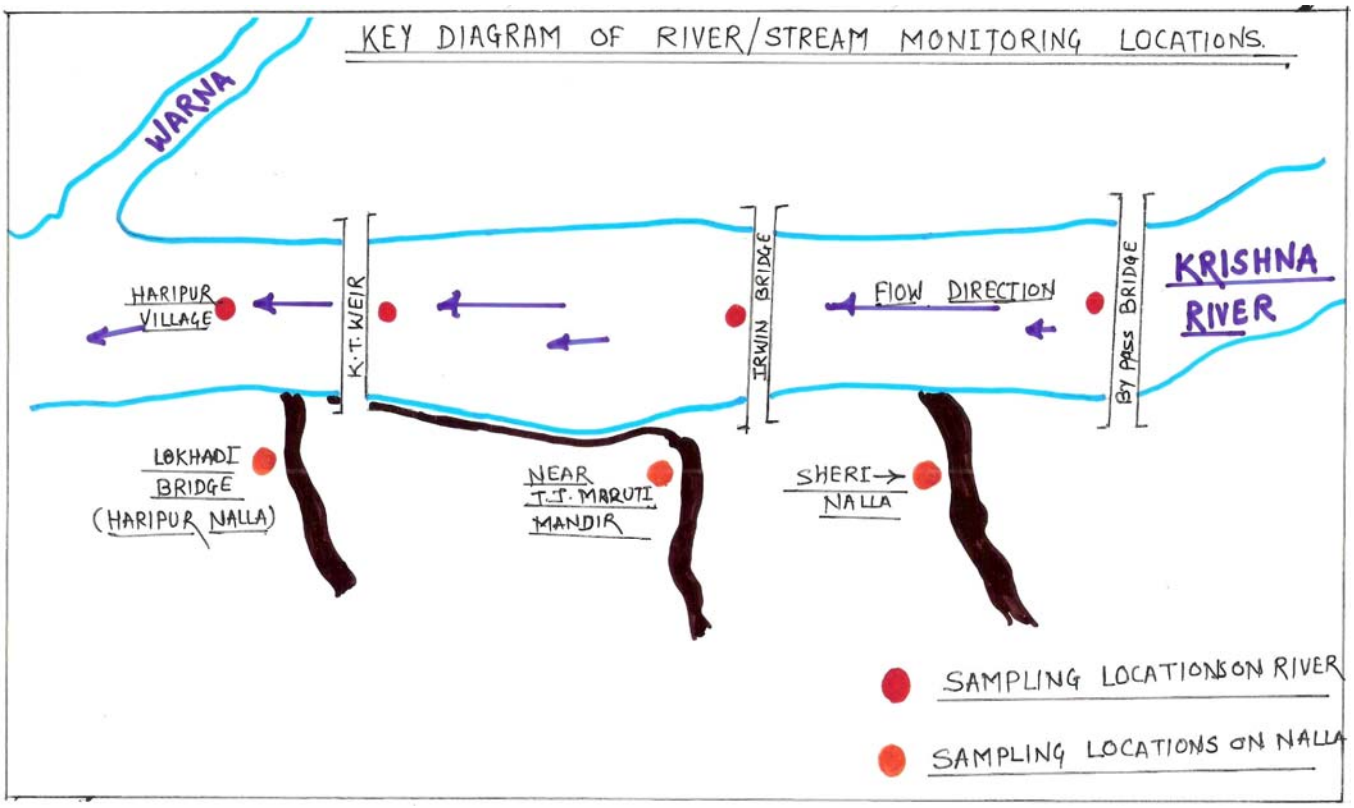


Figure 1: Key plan of location of sample

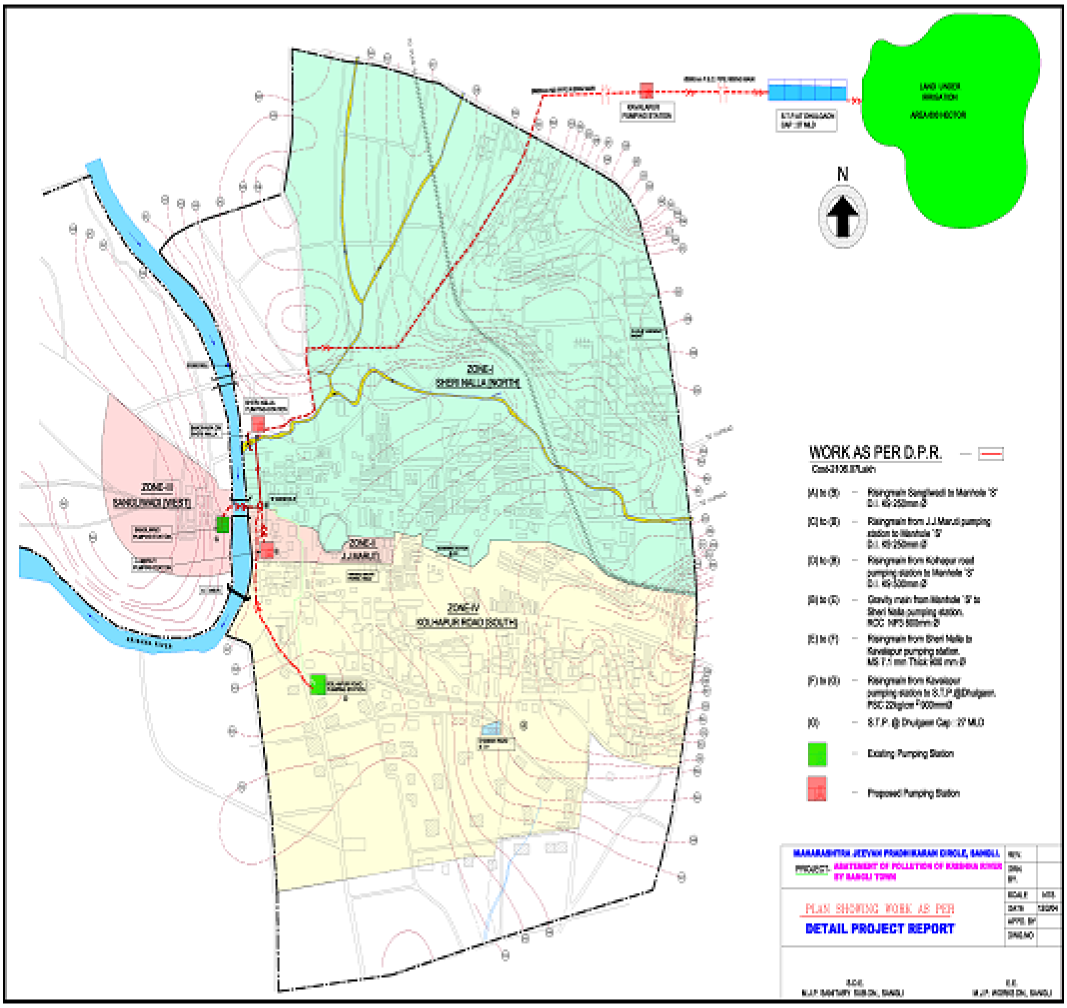


Figure 2: Map of proposed and present sewage treatment plant

2. Methodology for measurement of flow of river and waste water

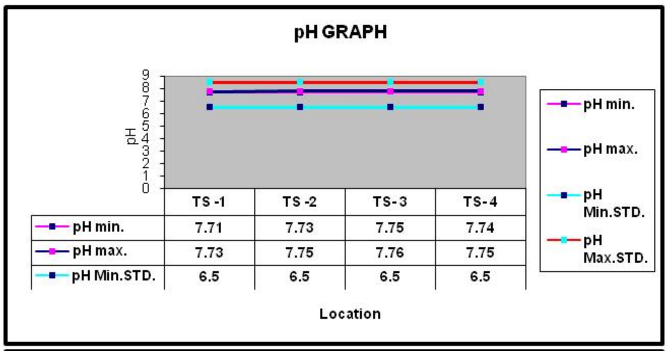
The area velocity method was used for river flow measurement .The cup type current meter (as per IS: 3910-1966) was used for this purpose. The flow measurements were carried out in association with Water Science Projects Department and Irrigation Department. The waste water flow was measured using "V"- notch. The Central Pollution Control Board, has published the guidelines in 2007 for the selection of monitoring locations, collection of water samples and to decide sampling frequency of surface water. These guidelines were adopted as for as possible for the present work. The grab samples were collected from the monitoring locations. River water samples were collected from the monitoring locations at a depth of 30 cm from the water surface for physico – chemical analysis. The river water and waste water samples were collected for a period of September 2008- April, 2009.The frequency of sample collection was decided twice in the month. Additional water and waste water samples were also taken to study effect of occasional changes in flow conditions. American Public Health Association guidelines were adopted for the analysis of the water and waste water samples. The physico-chemical analysis performed by standard methods. The brief details of analytical methods and equipment used in the study.

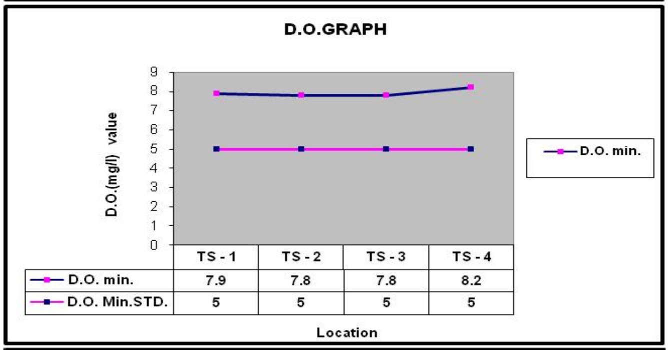
3. Results and Discussion

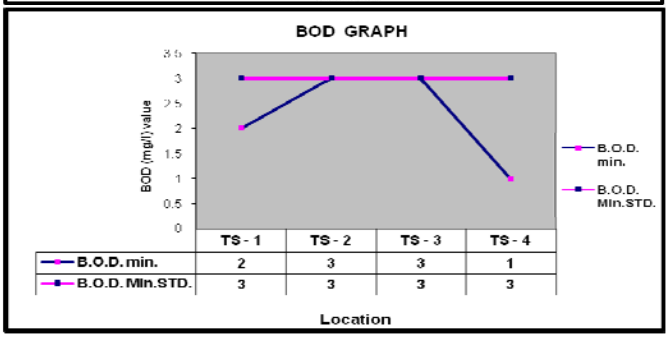
The observations made during the month of September are being considered for monsoon period. The flow through condition of river water from K.T.weir was observed throughout the monsoon season. The analyzed values of the pH parameter at all trend stations were between 7.71 to 7.76. The analyzed values of the DO parameter at all trend stations were between 7.8 to 8.4 mg/l. The analyzed values of the BOD parameter at all trend stations were between 1 to 10 mg/l. The analyzed values of the COD parameter at all trend stations were between 3.9 to 7.96 mg/l and the analyzed values of the chloride parameter at all trend stations were between 9.99 to 17.99 mg/l is observed. The average flow of waste water observed at NW-1, NW-2, and NW-3 were 244.37, 2402.38 and 1413.5 MLD respectively. K.T. weir was fully opened in this season. The waste water of three nallas was mix directly into the river. The bathing, cloth washing, and animal washing activities were observed at Mai Ghat (downstream of NW-1), TS-2 and at TS-3. Based on observations it can be concluded that during monsoon period the quality of river water in the stretch is well within the prescribed limits of CPCB. The characteristics of river water observed in monsoon season. are shown in Fig1. The depletion in the DO values from TS-2 to TS-3 was observed because of occasional overflow of waste water from NW-1.The back water of Warana river water enters into Krishna river near to TS-4, therefore the DO observed at TS-4 shows higher values. The analyzed values of the pH parameter at all trend stations were between 7.21- 8.2. The analyzed values of the DO parameter at all trend stations were between 8.2 -4.5 mg/l. The analyzed values of the BOD parameter at all trend stations were between 1.4 -8.2 mg/l. The analyzed values of the COD parameter at all trend stations were between 4.016- 31.62 mg/l. The analyzed values of the chloride parameter at all trend stations were between 41.98 -174.93 mg/l. The average flow of waste water observed at NW-1, NW-2, NW-3 were 681.94, 1288.462 and 3021.78 MLD. The characteristics of river water observed in post monsoon season are shown in Fig. 2. For winter season the analyzed values of the pH parameter at all trend stations were between 6.99 - 8.17. The analyzed values of the DO parameter at all trend stations were between 1.9 - 6.9 mg/l. The analyzed values of the BOD parameter at all trend stations were between 3.0 -13.58 mg/l. The analyzed values of the COD parameter at all trend stations were between 7.96 -40.0 mg/l. The analyzed values of the Chloride parameter at all trend stations were between 21.99 -183.90 mg/l. The average flow of waste water observed at NW-2 and NW-3 were 2051.747 and 2085.024. MLD as shown in fig.3. Due to dilution in winter season the analyzed values of the pH parameter at all trend stations were between 7.26 -7.9. The analyzed values of the DO parameter at all trend stations were between 3.1 – 6.9 mg/l. The analyzed values of the BOD parameter at all trend stations were between 4.2- 13.6 mg/l. The analyzed values of the COD parameter at all trend stations were between 7.75 – 46.51 mg/l. The analyzed values of the chloride parameter at all trend stations were between 35.98-359.82 mg/l. The average flow of waste water observed at NW-2 and NW-3 were 2031.715 and 2011.381 MLD as shown in fig.4. In summer season the analyzed values of the pH parameter at all trend stations were between 7.01 -7.79. The analyzed values of the DO parameter at all trend stations were between 3.2 -6.9 mg/l. The analyzed values of the BOD parameter at all trend stations were between 2.6 – 11.8 mg/l. The analyzed values of the COD parameter at all trend stations were between 7.91 – 31.87 mg/l. The analyzed values of the chloride parameter at all trend stations were between 21.99 - 99.95 mg/l. The average flow of waste water observed at NW-2 and NW-3 were 1647.56 and 1882.156 MLD as shown in fig.5. Due to dilution in summer season the analyzed values of the DO parameter at all trend stations were between 4.2 -6.3 mg/l. The analyzed values of the BOD parameter at all trend stations were between 2.0 – 6.80 mg/l. The analyzed values of the COD parameter at all trend stations were between 7.97 – 23.90 mg/l. The analyzed values of the chloride parameter at all trend stations were between 37.98 – 69.97 mg/l. The average flow of waste water observed at NW-2 and NW-3 were 1716 and 1534.08 MLD as shown in fig.6. For stagnant conditions the analyzed values of the pH parameter at all trend stations were between 7.21 -7.68 mg/l. The analyzed values of the DO parameter at all trend stations were between 3.1 -5.1 mg/l. The analyzed values of the BOD parameter at all trend stations were between 4.4 - 10.40 mg/l. The analyzed values of the COD parameter at all trend stations were between 8.03 – 31.62 mg/l. The analyzed values of the chloride parameter at all trend stations were between 37.98 -127.94 mg/l. The average flow of waste water observed at NW-2 and NW-3 were 1856.08 and 1944.29 MLD as shown in fig.7 By using Streeter Phelps's equation minimum DO concentration is calculated and as shown in fig.8

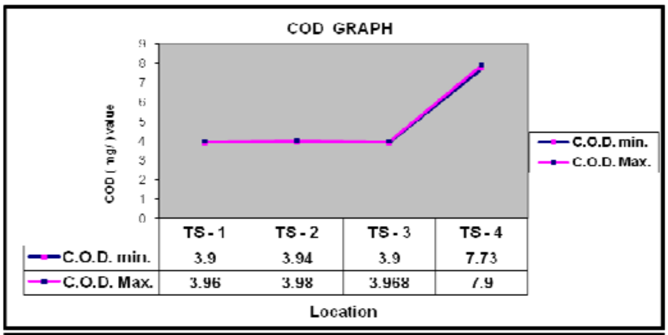
Figure 3: Flowmeasurementnear J. J. Maruti Mandir Nalla

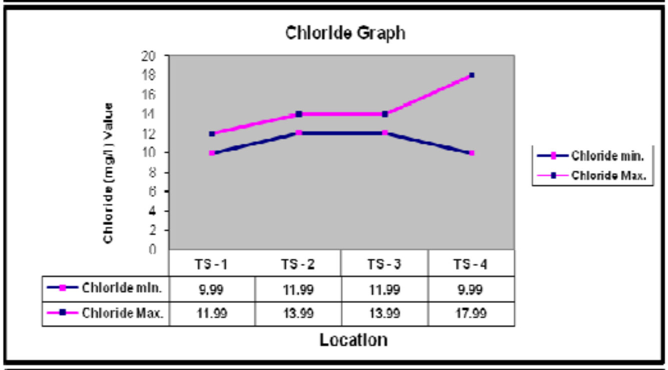
Figure 4: Flow Measurement at Haripur Nalla











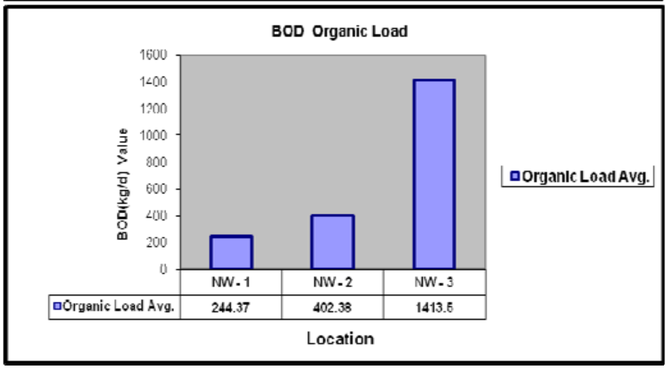
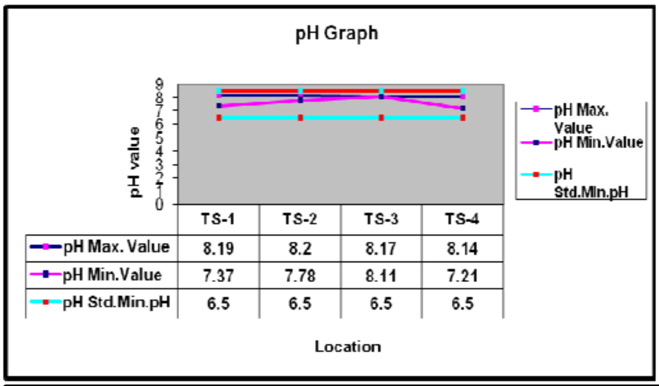
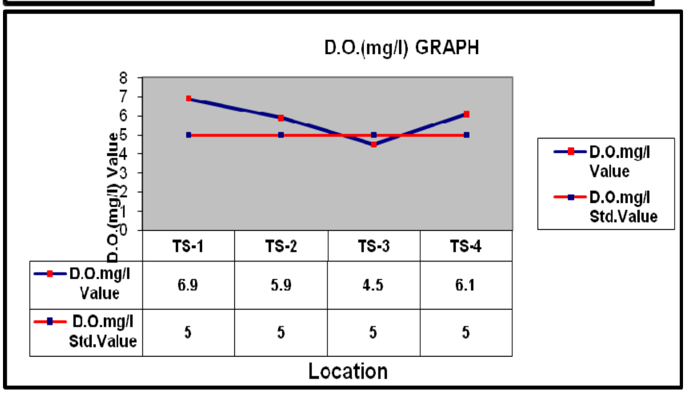
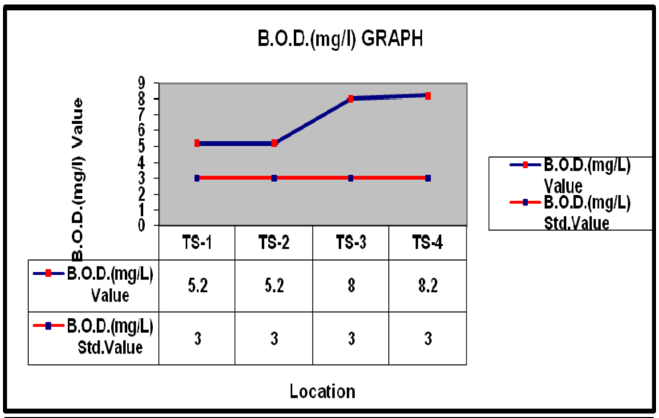


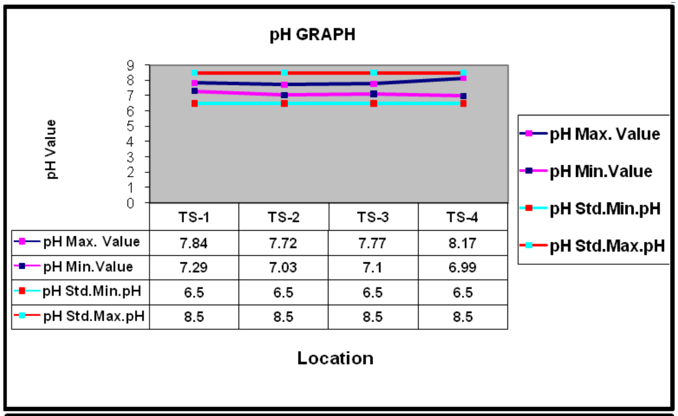
Figure 5: MONSOON SEASON flow with characteristics of waste water



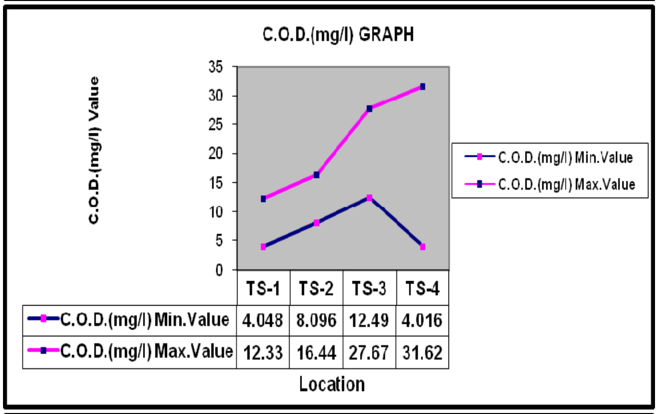




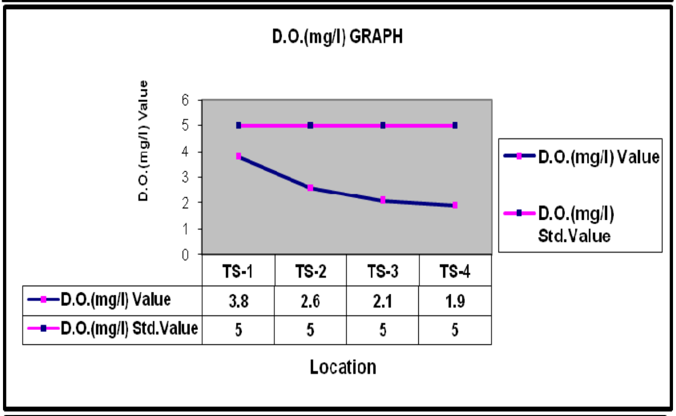
	TS-1	TS-2	TS-3	TS-4
B.O.D.(mg/L) Value	5.2	5.2	8	8.2
B.O.D.(mg/L) Std.Value	3	3	3	3



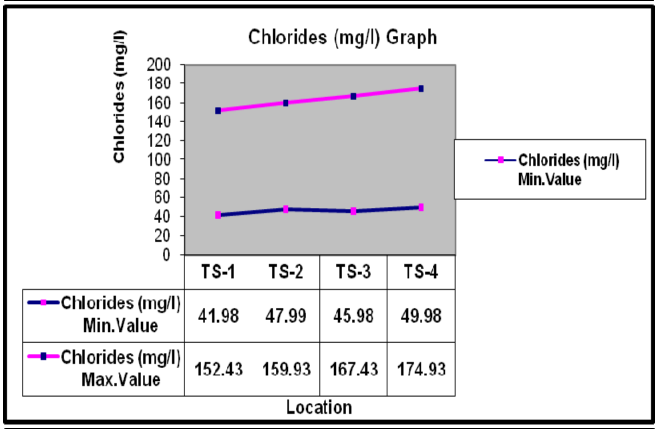
	TS-1	TS-2	TS-3	TS-4
pH Max. Value	7.84	7.72	7.77	8.17
pH Min.Value	7.29	7.03	7.1	6.99
pH Std.Min.pH	6.5	6.5	6.5	6.5
pH Std.Max.pH	8.5	8.5	8.5	8.5



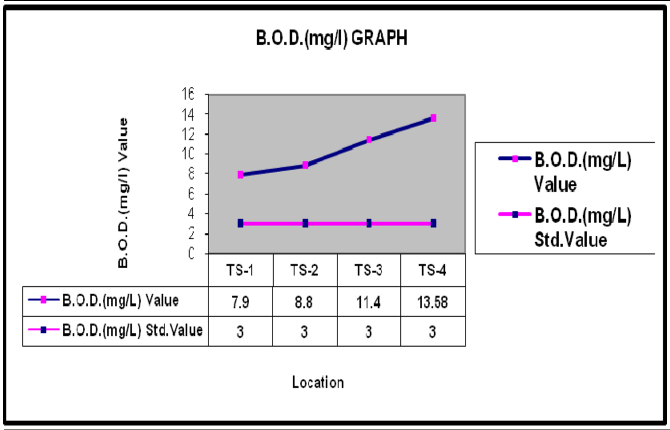
	TS-1	TS-2	TS-3	TS-4
C.O.D.(mg/l) Min.Value	4.048	8.096	12.49	4.016
C.O.D.(mg/l) Max.Value	12.33	16.44	27.67	31.62



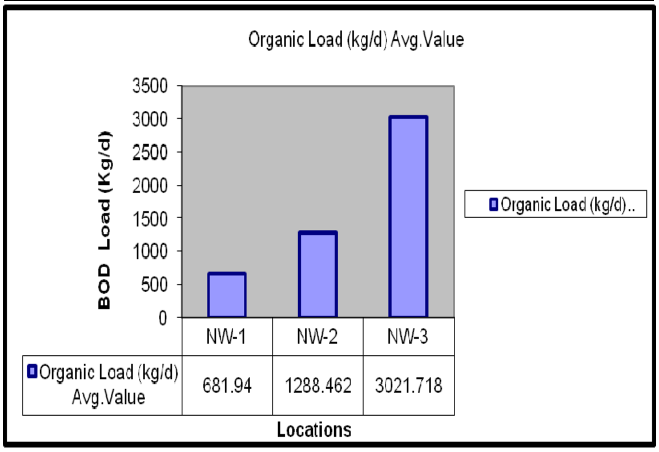
	TS-1	TS-2	TS-3	TS-4
D.O.(mg/l) Value	3.8	2.6	2.1	1.9
D.O.(mg/l) Std.Value	5	5	5	5



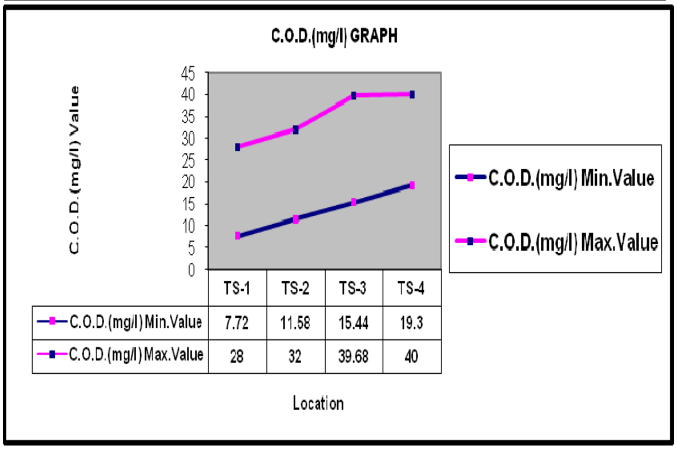
	TS-1	TS-2	TS-3	TS-4
Chlorides (mg/l) Min.Value	41.98	47.99	45.98	49.98
Chlorides (mg/l) Max.Value	152.43	159.93	167.43	174.93



	TS-1	TS-2	TS-3	TS-4
B.O.D.(mg/L) Value	7.9	8.8	11.4	13.58
B.O.D.(mg/L) Std.Value	3	3	3	3

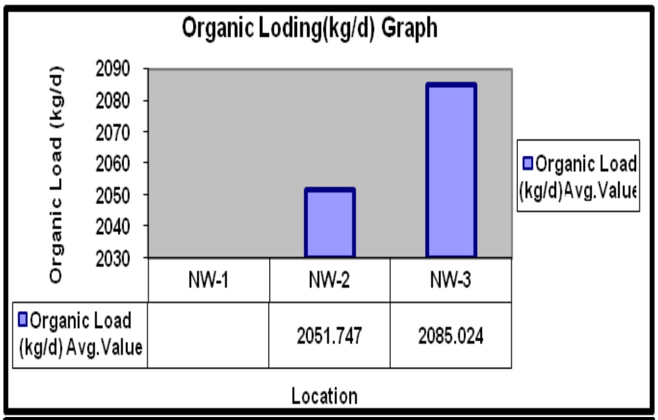


	NW-1	NW-2	NW-3
Organic Load (kg/d) Avg.Value	681.94	1288.462	3021.718



	TS-1	TS-2	TS-3	TS-4
C.O.D.(mg/l) Min.Value	7.72	11.58	15.44	19.3
C.O.D.(mg/l) Max.Value	28	32	39.68	40

Figure 6: POST MONSOON SEASON flow with characteristics of waste water



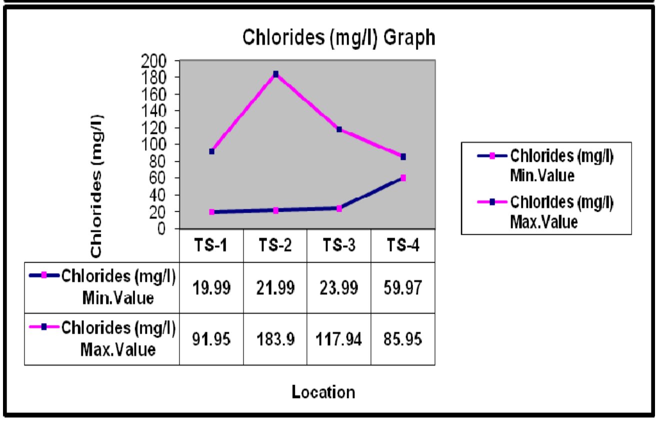
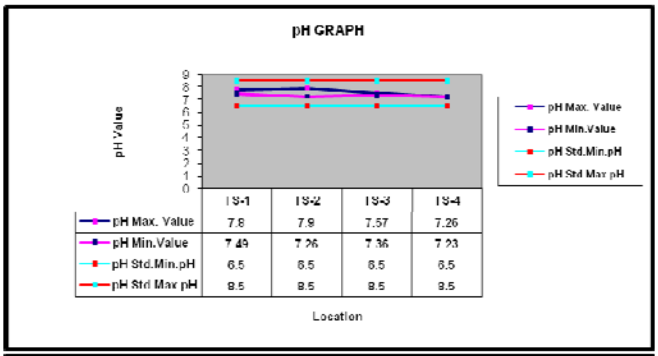
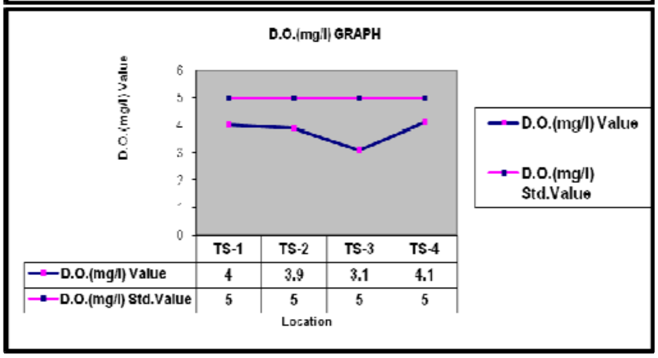
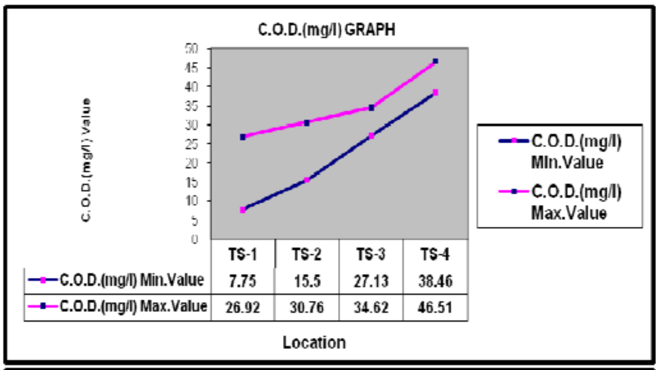
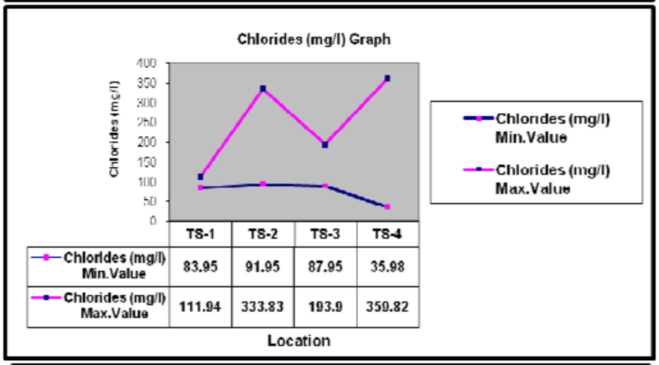


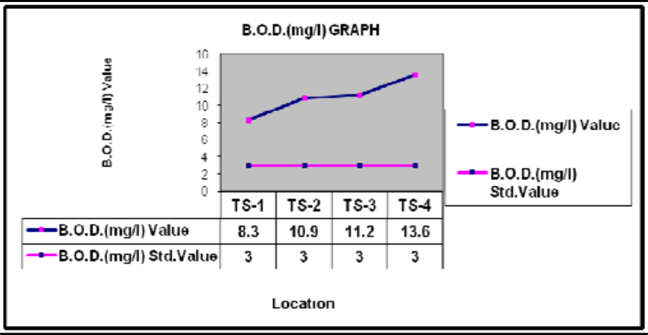
Figure 7: WINTER SEASON flow with characteristics of waste water











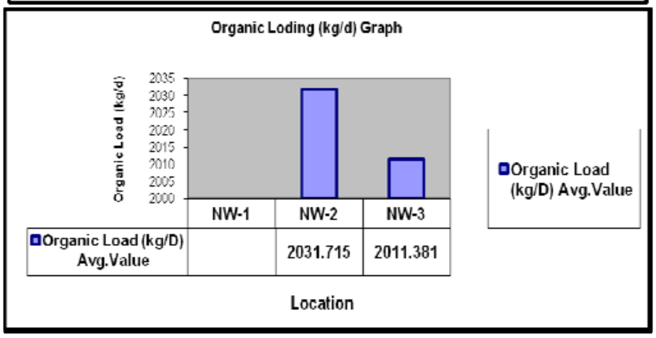
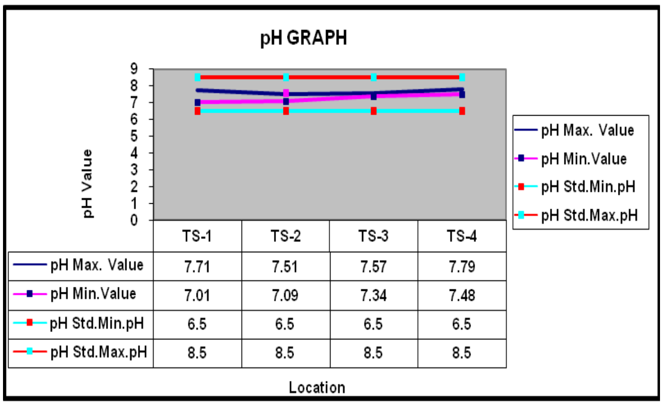


Figure 8: WINTER SEASON flow with characteristics of waste water and dilution condition



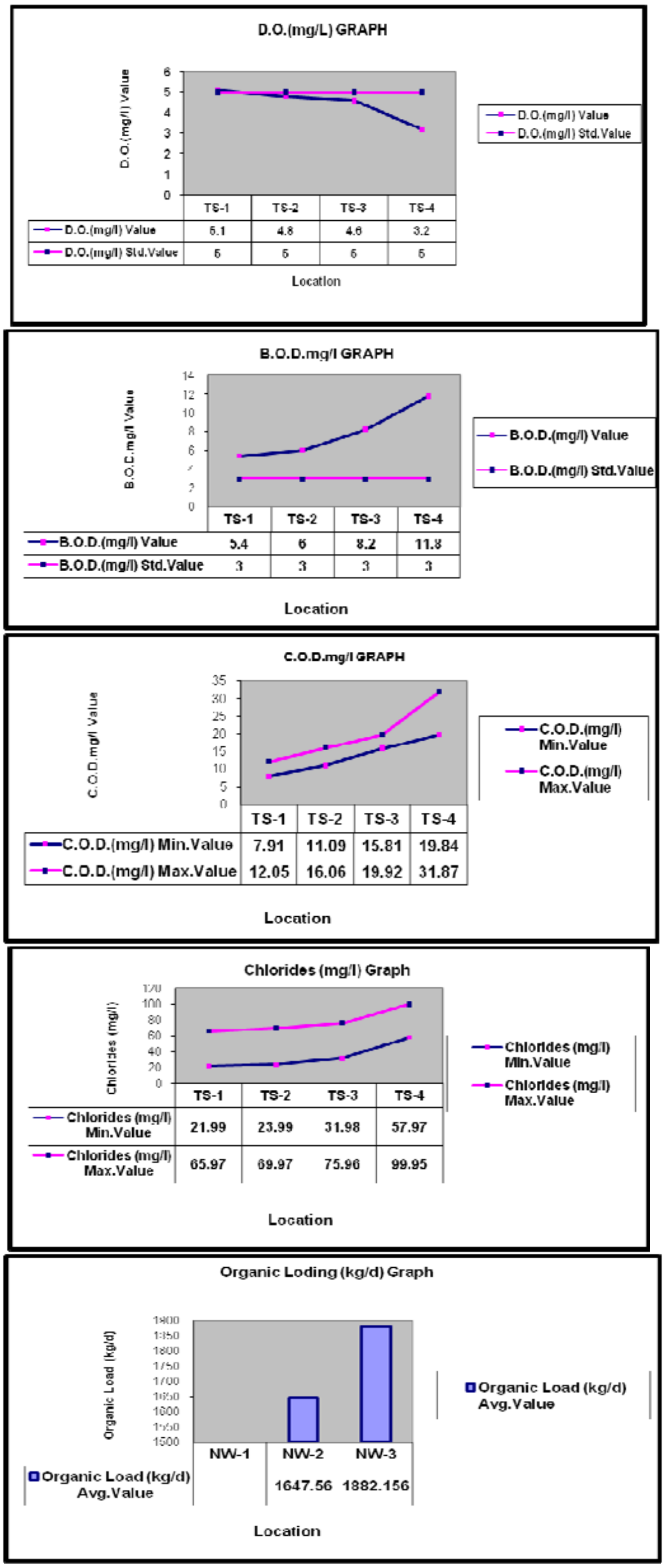


Figure 9: SUMMER SEASON flow with characteristics of waste water

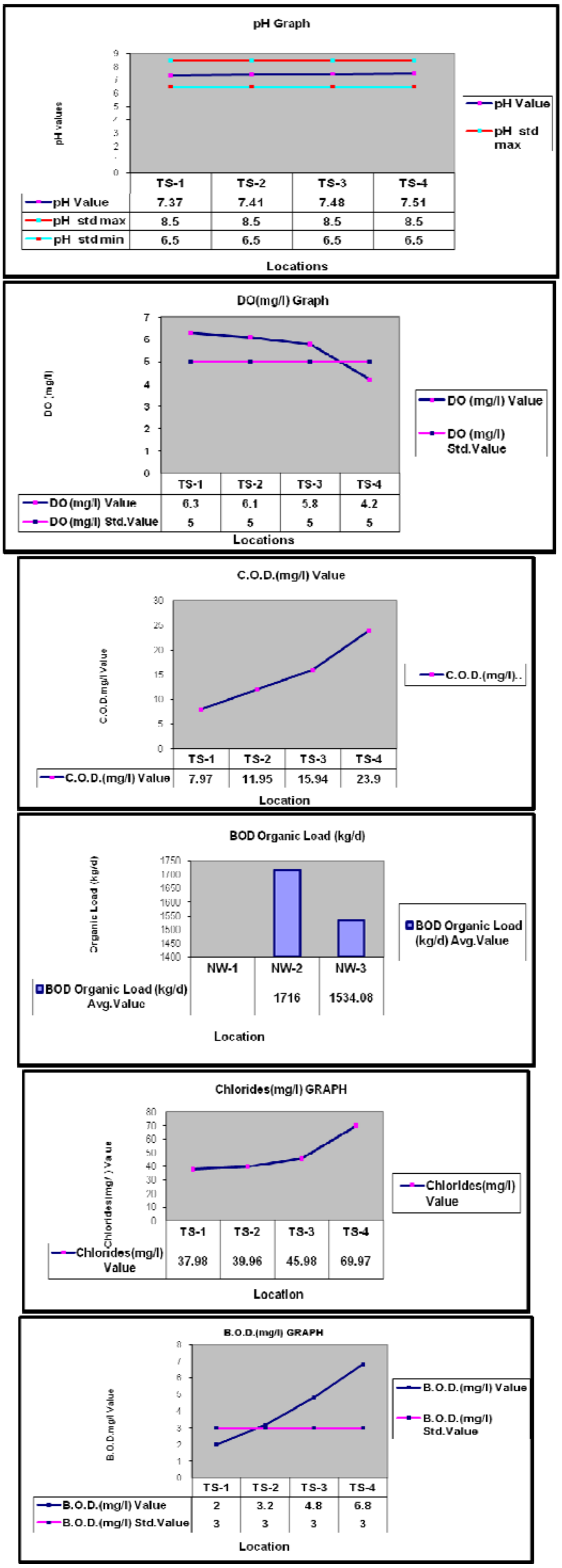
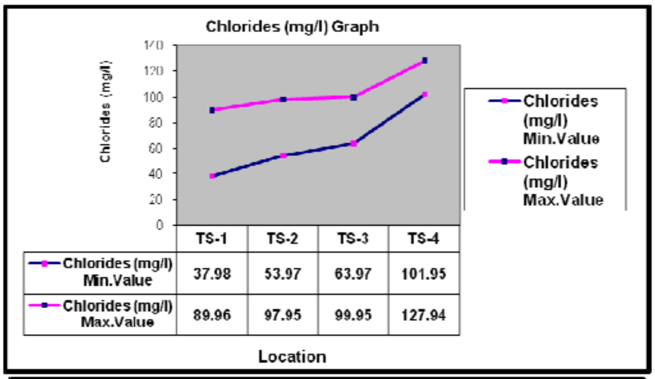
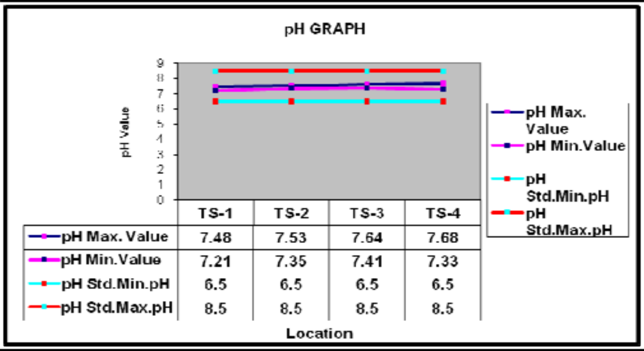
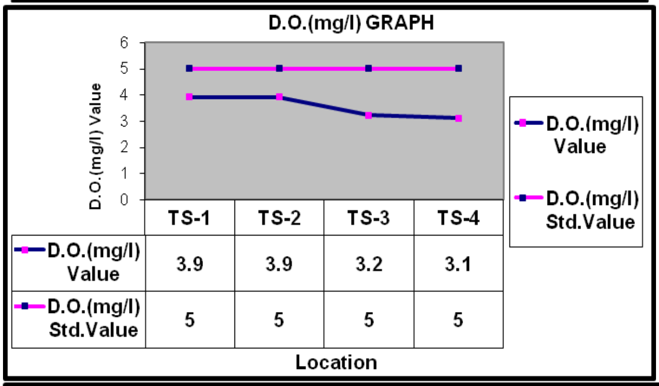
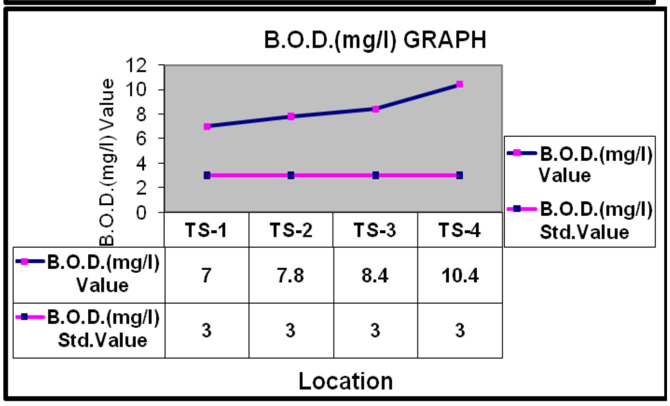


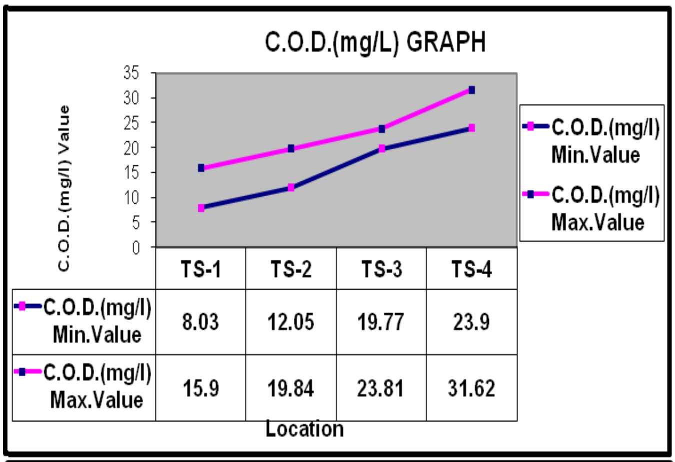
Figure 10: SUMMER SEASON flow with characteristics of waste water and dilution condition











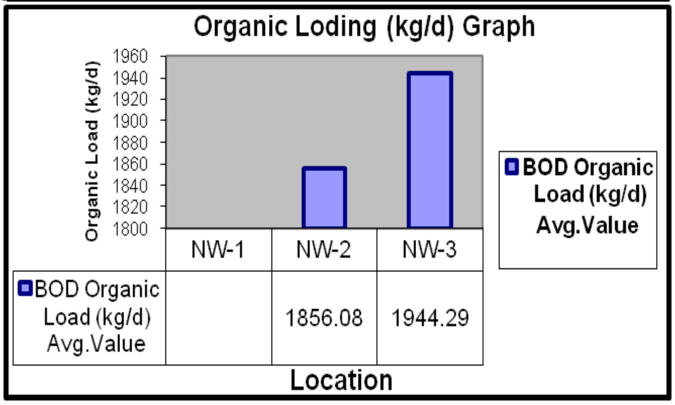


Figure 11: SUMMER SEASON flow with characteristics of waste water and STAGNANT CONDITION

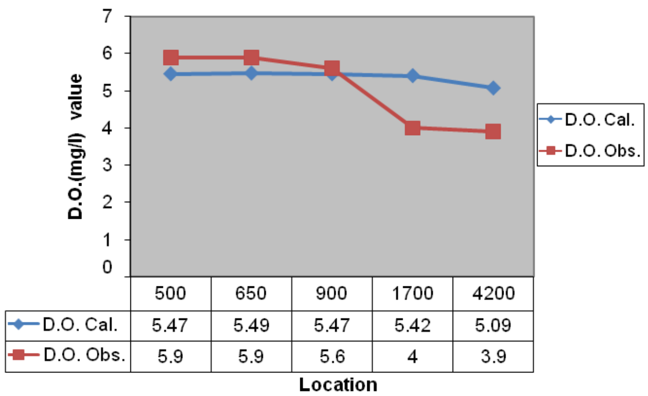


Figure 12: STREETER PHELPS APPLICATIONS (Minimum DO Concentration)

4. Conclusions

The pollution study of Krishna river stretch from Sangli to Haripur was carried out form September 2008 to April-2009.The following conclusions drawn based on the findings of the study. 1. During monsoon period, the pollution in the study stretch was found not exceeding the prescribed limits, Due to sufficient dilution of waste water. 2. In the post monsoon period, Due to the pollution in the study stretch DO was found depleted below the prescribed limits due to insufficient dilution. The lowest DO value once was 4.5 mg/l at the trend station no.3 (TS-3) in this period. 3. In the winter season ,due to the pollution in the study stretch DO was found depleted below the prescribed limits due to insufficient dilution .The lowest DO value once was 1.9 mg/l at the trend station no.4 (TS-4) in this period. 4. During summer season the river flow was minimum (0.25 m^3/s). It was found that DO values were lower than prescribed limits for the whole period. The stretch was suffering from pollution for the whole period. 5. The presence of chlorides in the river water stretch indicates that river pollution is due to mixing of untreated sewage to some extent. 6. The maximum flow of waste water was observed in Haripur nalla (NW-3). The higher concentration of waste water was in NW-3 comparatively NW-1 and NW-2.The waste oil traces observed in NW-3. The high BOD organic load was observed in NW-3, due to this the quality of river water was more affected between TS-3 to TS-4. 7. Though municipal authorities plug the channel of the Sheri nalla, occasionally overflow of waste water mixes into river water and causes river water pollution in this stretch. 8. The bathing, cloth washing, animal washing, vehicle washing activities were observed at Mai Ghat (downstream of Sheri nalla), Irwin bridge and at K.T.weir. The seepages and accidental overflow of waste water from Sheri nalla was observed. People were disposing the solid waste material at upstream of the K.T.Weir. All these factors were contributing to river water pollution in this stretch. 9. The exiting treatment facility for waste water is found inadequate. The suggested pollution control measures in the present study are essential to improve the river water quality in the stretch, Sangli to Haripur. The best waste water management method suggested as low cost method is oxidation pond and economical method is conventional ASP waste water treatment plant.

5. Future Scope

The above research work further can be extended for solving problems of different kind of project for the betterment of society.

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