Lateral Variation of Physicochemical Properties of Surface Water around Dhaka Export Processing Zone (DEPZ) Savar, Bangladesh

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Abstract: The study was carried out in order to investigate the nature and extent of pollution in the water body of dhalai beel area located at dhamsona at savar, Dhaka due to the industrial effluents discharged from the Dhaka export processing zone (DEPZ). 20 samples in the wet season and 20 samples in the dry season were collected from the selective points of the water body. Among twenty sampling point four sampling points was the source point and consecutive sampling points have a distance of hundred meters between them. The parameters such as odor, color, temperature, PH, EC, TSS, TDS, Total alkalinity, Total hardness, DO, BOD, COD, Turbidity were measured by using different instrument. Total study area was around one and half kilometer area. From the source point to half of the area (sampling point 5 to 12) maximum physicochemical parameter concentration was higher. After this area consecutive sampling area (nearly (0.75 Km area) physicochemical parameter concentration was lower. The intensity of pollution decreased in both the season and the levels of the parameter were relatively higher in the dry season than that in the wet season. Especially sampling points 11 and 12, concentration was higher than the others, because there was a pocket area. As a whole the result of this study have showed that the surface water around DEPZ up to 0.75 km area was highly impacted due to continuous mixing of the effluents and is quite unsuitable but remaining 0.75 km area is quite suitable to serve aquatic and agricultural purpose.

Key words: Industrial Discharge, Bio-accumulation, Zero Discharge System ETP, Heavy Metal, Bangladesh.

INTRODUCTION

Due to industrialization surface water pollution has become a serious threat all over the world. The surface water was carried the composite effluents discharged by DEPZ industries into dhalai beel which in turn drain the load into the bangshi river. In view of the spatial and temporal variations in the hydrochemistry of surface water, regular monitoring programs are required for reliable estimation of the water characteristics. The quality of water depends on the ambient pollution concentration in the water bodies. The ambient pollution concentration depends on the amount of pollutant emitted and disposed of into the aquatic environment and the amount of pollutant remaining in environment. Among the pollution in different types physicochemical effects are very important type pollution (M.A.A Mahfuz, JU Ahmed et al 2004). Many pollutants produce undesirable odor, taste, and color in water and make it unpleasant and harmful for drinking and daily use purposes. These changes may be in pH, Temperature, and content of oxygen which affect the physicochemical nature of water. Acceptable limit of pH for drinking water is 6.0 to 8.5 (BSTI,1989), DO the acceptable limit is 6.5 to 8.5 ppm (WHO, 1991) and BOD for drinking water is 0 to 1 according to British standard (Andrews 1972). For the surface or inland water recommended limit is 300 and for fishing purpose it should not be >350c (A.Ahmed, D.A chowdhury et al 2007).

Dhaka Export Processing Zone (DEPZ) is the secondly established EPZ of the country that serves houses of several leading pollution creators' industrial units including cap/accessories/garments, textile/knitting, plastic goods, footwear/leather goods, metal products, electronic goods, paper products, chemical and fertilizer and miscellaneous (Khan, 2011). It has been inaugurated that 30% of industry in DEPZ is textile and dyeing oriented ((A. Ahmed, D. A Chowdhury et al 2007).). Most of the industries of DEPZ generate a large amount of effluents, solid waste materials everyday which are being directly discharged into the surrounding agricultural land, surface water and finally enter through the dhalai beel into the Bangshi river. Therefore effluents discharged from DEPZ has a strong color, a high temperature, a high fluctuating PH and EC, large amount of Dissolved solids, high BOD, COD, Alkalinity, Hardness, and low DO (Kabir,2002 & O. R.Yusuff,2004). Every industrial unit is supposed to have effluent treatment plant (ETP) to treat the respective waste water they generate. However, so far only a few industries have installed such plants. Even then most of the plants operate occasionally only to be qualified to international buyers and to get clearance certificate from department of environment DOE. So in the present study we tried to determine the extent of pollution level of various physicochemical parameters in order to characterize the effluents of different industries inside DEPZ area. Further the impact of the pollutants of the effluents on the surface water quality was also determined by measuring the pollution level of the various parameters of the surface water of the DEPZ area of the studied industrial area.

OBJECTIVES OF THE STUDY

The objectives of the study are as follows:

1. To assess the level of 14 selective physicochemical characteristics of water body, taking the samples in systematic process along the waterway both in the dry and in the wet season.
2. To compare the source point value and consecutive value with the standard recommended value.
3. Finally from the disposal sites (source point of industry) to observe the status of the physicochemical parameters of consecutive sampling points have a distance of hundred meters between them.

MATERIALS AND METHODS

Sampling site was belongs to Dhamsona Union under Savar Upazila of Dhaka District, located about 35 km south-east from the capital city Dhaka of Bangladesh. Samples were collected in two different seasons- dry and wet season from twenty (20) different locations adjacent to DEPZ. Among twenty sampling point four points was the source point and difference of one source point to next sampling point was approximately 100 meters. The locations of the sampling sites were given in Table I.

Table I: Locations of the sampling sites

Sampling Site	Location of Sampling site	Sampling Site	Location of Sampling Site
1	23.946053^{0}N and 90.265240^{0}E	11	23.949238^{0}N and 90.260316^{0}E
2	23.946917^{0}N and 90.264917^{0}E	12	23.948207^{0}N and 90.258706^{0}E
3	23.947027^{0}N and 90.264257^{0}E	13	23.947698^{0}N and 90.257846^{0}E
4	23.9477540Nand 90.264271^{0}E	14	23.948470^{0}N and 90.257492^{0}E
5	23.947746^{0}N and 90.263501^{0}E	15	23.948967^{0}N and 90.256593^{0}E
6	23.948004^{0}N and 90.262884^{0}E	16	23.949068^{0}N and 90.256891^{0}E
7	23.948469^{0}N and 90.262741^{0}E	17	23.948869^{0}N and 90.257090^{0}E
8	23.948972^{0}N and 90.262335^{0}E	18	23.948472^{0}N and 90.256789^{0}E
9	23.949233^{0}N and 90.261703^{0}E	19	23.947799^{0}N and 90.246990^{0}E
10	23.949385^{0}N and 90.261023^{0}E	20	23.947689^{0}N and 90.247689^{0}E

Sample analysis:
The physicochemical parameters of effluents samples and surface water samples were analyzed by different standard methods in analytical research Division, BCSIR laboratories, Dhaka. Physicochemical parameters such as color, odor, Temperature, Total suspended solid (TSS), Total dissolved solid (TDS), Dissolved oxygen (DO), hydrogen ion concentration (PH), electrical conductivity (EC), turbidity, Biochemical oxygen demand (BOD), Chemical oxygen demand (COD) of the samples were measured using various standard methods. TSS were measured by filtration method dried at 103-105^{0}c. COD, hardness, and alkalinity were measured by titrimetric method. Temperature, PH, EC, TDS, DO, BOD, salinity, and turbidity were measured by portable multi parameter sension^{TM}156.

RESULTS AND DISCUSSION

The result of physico-chemical parameters of the effluent water samples are presented in Table II, III, IV &V

Table II: Concentrations of the physico-chemical properties of the effluent of the source point (sample no.1-4) in the dry season

Parameter	Minimum	Maximum	Mean	Std. Dev.(±)
Temperature(0C)	32.3	34.6	33.4	0.319
EC (μs/cm)	2000	2790	2565	327
TDS (mg/l)	1396	1423	1406	10.31
TSS (mg/l)	48.4	235	127	0.078
Salinity (PPT)	1.4	1.4	1.4	0
P^H	7.46	11.7	8.94	1.71
Turbidity (NTU)	8.47	77.6	53.1	26.9
DO (mg/l)	0.77	4.9	2.76	1.76
BOD (mg/l)	1.37	47.8	22.2	20.6
COD (mg/l)	2.88	28.8	11.8	10.39
Alkalinity (mg/l)	838	1843	1131	414
Hardness (mg/l)	50	91.6	77.0	17.0

Table III: Concentrations of the physicochemical properties of the effluents of different industries in DEPZ area (Dry season) (Sampling point 5-20).

Parameter	Minimum	Maximum	Mean	Std. Dev.(±)
Temperature(0C)	31	38.63	34.6	3.06
EC (µs/Cm)	1620	3300	2406	410
TDS (mg/l)	803	1694	1222	216
TSS (mg/l)	31.6	5024	777	1.29
Salinity(PPT)	0.8	1.7	1.2	0.221
P^H	7.54	9.78	8.84	0.761
Turbidity (NTU)	3.14	2530	262	617
DO (mg/l)	0.11	3.1	0.90	0.932
BOD (mg/l)	11	293	77	74.7
COD (mg/l)	3.8	202	57.9	44.6
Alkalinity (mg/l)	603	1139	836	136
Hardness (mg/l)	62.4	133	98.4	20.6

Table IV: Concentrations of the physicochemical properties of the source point (sample no.1-4) effluents of different industries in DEPZ area (wet season)

Parameter	Minimum	Maximum	Mean	Std. Dev.(±)
Temperature(0C)	30.3	33.6	31.8	1.36
EC (µs/cm)	861	2360	1410	605
TDS (mg/l)	421	1197	702	313
TSS (mg/l)	.0008	2.0	1.0	0.6
Salinity	0.4	1.2	0.67	0.326
P^H	7.8	9.9	9.1	0.867
Turbidity (NTU)	3.32	23.8	13.8	0
DO (mg/l)	0.33	1.00	0.627	0.240
BOD (mg/l)	28.8	125	89.5	36.5
COD (mg/l)	7.93	63.5	35.7	27.8
Alkalinity (mg/l)	367	1059	744	247
Hardness (mg/l)	59.9	79.8	69.8	7.17

Table V: Concentrations of the physicochemical properties of the effluents of different industries in DEPZ area (wet season) (Sampling point 5-20)

Parameter	Minimum	Maximum	Mean	Std. Dev.(±)
Temperature(0C)	30.0	33.23	31.46	0.402
EC (µs/cm)	775	1245	917	116
TDS (mg/l)	379	597	450	54.0
TSS (mg/l)	<1	312	32.3	74.4
Salinity (PPT)	0.3	0.6	0.44	0.066
P^H	7.8	9	8.50	0.343
Turbidity (NTU)	0.73	19.7	5.53	4.71
DO (mg/l)	0.11	3.04	1.0	0.961
BOD (mg/l)	2.4	251	96	71.7
COD (mg/l)	7.4	450	70.4	111
Alkalinity (mg/l)	44.8	489	372	126
Hardness (mg/l)	59.9	150	82.4	31.6

The concentration ranges of the physicochemical properties with the average value (sample no.5-20) of the effluents of the study area are shown in table [III and V], and the concentration ranges of the physicochemical properties with the average value of the source point sample (sample no.1-4) in dry and wet season are shown in table [II and 1V] respectively. The levels of pollution of the effluents were determined by comparing the observed values of the various parameters with the surface water standard value recommended by DOE, Bangladesh (ECR, 1997).

Highly colored liquid effluents with pungent odor were observed in the effluents of the studied industrial area. Highly color and bad odor were due to huge amount of organic dyes and odor bearing materials discharging from textile, dyeing and different type of factories. But the strength of color and odor decreased from the source point to towards the beel due to dilution effect.

In the present study temperature ranged in the dry and wet season from 31-38.6°C and 30-33.7°C respectively (sampling point 5 to sampling point 20). Average values were found 34.3°C and 31.3°C respectively. Source point values were 38.60c and 33.20c respectively. The temperature in the study area in dry and wet season in different sample points is given in (Fig.1). From the figure it is evident that in dry season the temperature gradually falls from the first source point to the 4th source point, but after that there was a sharp decrease in temperature from sampling point 4 to sampling point 5.The similar type of fall in temperature also observed from sampling point 11 to 12 and after that similar and previous. During wet season the temperature showed a gentle downward movement from sampling point 5 to sampling point 20. Source point average values are higher than the remaining values in both the season. In the study area all sampling point concentration are within the DOE standard in both season (table V11). For the surface water or inland water bodies recommended limit of temperature is 30°C (Huq, 2002) and for fishing purpose it should not be > 35°C (Ahmed, 2009). Similar results of temperature were found in the study of in the DEPZ area of Dhaka and Dhalai beel area of Savar studied by (Ahmed, 2007). The high temperature value suggested that water from this area may be harmful for drinking purpose and fish grown in this area may be toxic.

Electrical Conductivity (EC) is an important parameter for determining the water quality. EC values become high when a number of ionic substances like sodium, potassium, magnesium, iron etc. are released from industries. In the present study the EC values (sampling point 5-20) ranges from 1620-3300 μs/cm in dry season and 775- 1245 μs/cm in wet season. Average values are 2406.25 and 917.37 μs/cm. Source point average values are 2565 μs/cm and 1409 μs/cm during dry and wet season respectively. Source values are higher than the remaining values in both seasons. During dry season observed EC values is much higher than the recommended value 1200 μs/cm (ECR, 1997; Park, 1980). Figure (2) shows that in dry season an abrupt increase was observed in maximum sampling point and sharp decrease at sampling point 15. It is also found that effluent samples contain EC concentration is nearly 3 times higher than the DOE standard (Table VII) in the sampling point 11 and 12. This value indicate that there might be a source of ionic substances or ionic substances may be deposited there or may be washed out from the source point of nearby industries and for decrease in EC value in sampling point 15, this might be because of water in that place may be diluted from other sources. On the other hand in rainy season the concentration of EC value is observed highest in the source point 1 and 2 sampling point. Then there was a sharp decreased in sampling point 3 and 4. After that the EC values showed a gradual change up to 10th sampling points. But after that a gradual decrease in EC values also observed. In wet season maximum sampling point concentration except three sampling point are within the DOE standard. EC values also suggested that the water should not be used for irrigation of crops and vegetables in dry season.

TDS in water mainly consist of ammonia, nitrite, nitrate, phosphate, alkalis, some acids, sulfates, metallic ions, etc. The study found that the average value of TDS 1222 mg/L and 450 mg/L during dry and wet season respectively (sample no. 5-20). The range of TDS during dry season is 803 mg/L to 1694 mg/L and in wet season variation is in between 379 to 597 mg/L. Source point average values are 1406 mg/L and 702 mg/L respectively which is higher than other sampling point. (Figure 3) indicate the TDS level in different sampling point in both wet and dry season respectively. It was observed that the concentration of TDS is much higher during dry season than wet season. During dry season the TDS value is almost same in source points and as like other sample there is also an abrupt change found in the sample points 11 and 12. It may be due to a pocket has been created on the points. After the sampling point 11 and 12, remaining sampling point concentration are decreasing towards the beel.

According to (ECR, 1997) the recommended value (Table VII) of total dissolved solids (TDS) for irrigated land, public sewer at secondary treatment plant and recreational water is 2100 mg/L. This indicates that TDS value as no or minimum contribution to contaminant water in the study area. High TDS value of effluent is not desirable because high content of dissolved solids elevates the density of water influences osmo-regulation of fresh water organisms reduces solubility of gases (like oxygen) and utility of water for drinking irrigational and industrial purposes. Total suspended solids denote the suspended impurities present in the water. Measurement of suspended particulate matter is important as they are responsible for pollutant transport in the aquatic environment. Higher TSS values in water may cause bad odors and taste and also may promote conditions favorable for growth of pathogenic bacteria. TSS values of the effluents of the study area lie between 31.6 to 5024 mg/L and less 1 to 312 mg/L in dry and wet season respectively. Average values are 777mg/L and 34.4 respectively (sampling point 5-20). Source point average values are 127 and 1.0 mg/L respectively which is less than the remaining sampling point average value. Fig. shows an abrupt change in sampling point 16 and sampling point 17 in dry season and sampling point 16 in wet season. In dry season the observed values of TSS crosses the limit in maximum sampling point. But in wet season the value was always lower than the recommended limit. It is found that the effluent samples contain TSS concentration about 5 times higher than DOE standard in dry season. In wet season the TSS value was lower than the recommended value 150 mg/L according to (ECR, 1997). It is obvious that during rainy season dilution effect has lowered the value of TSS. The total suspended solid (TSS) did not show any source distance relation during both the seasons (Fig. 4).

Salinity is an important parameter for determining water quality. High concentration of salinity indicates the presence of Chlorine and Sodium in a water sample. The average salinity measured in the water sample 1.23 PPT and 0.42 PPT in dry and wet seasons respectively. Seasonal variation of the salinity is observed. In case of dry season the salinity value was almost same for the source points, and like other parameters it also showed an abrupt change in the sampling points 11 and 12 (Fig. 5). It may be due to a pocket has been created on that point. After that the remaining sampling point concentration is decreasing towards the beel. Unlike dry season no such variation is observed in wet season. The highest value of salinity in wet season was observed in first source points. After that a sharp decreased observed to the second and third source points. PH variation is primarily caused by different kinds of dye stuff used in the dyeing process in different industries. In this study area the PH value ranges from 7.54 to 9.78 in dry season and 7.80 to 9.13 in wet season (Figure. 6). Average values are 8.84 and 8.50 in dry and wet season respectively (sample no.5-20). Source point concentration values are 8.9 and 9.1 respectively. Source point values concentration and remaining sample average concentration values are very closer. It is to be noted that in dry season from sampling point 11 to 20 the pH values are decreasing than the above values and values are within the DOE standard (table-VII). Unlike variation no such variation is observed in wet season. So in dry season more than half studying area and in wet season except two source point all studying area are not contaminated by pH. The result of PH also indicated that the PH in the study area exists in a tolerable limit between 6 to 9 (ECR, 1997) Excessive PH is harmful to aquatic life like fish and microorganism etc. (Yusuff et al., 2005).

Turbidity in natural water arises due to the presence of suspended matter such as clay, slit, organic matter, phytoplankton, decomposed dyeing agents and other microscopic organisms (Ahmed et al., 2007). Turbidity of water sample mostly depend on the amount of suspended solid (Fenner and Robert, 2005). The average turbidity observed 115.30 during dry season and 6.02 in wet season. The turbidity value was suddenly increased in sampling point 17. To the same sampling point the TDS value was higher than the other sampling point TDS value. So it agrees the above comment. The turbidity values in the sampling sites did not show any source distance relationship (Fig. 7). But the turbidity value is several folds higher in dry season than wet season. It is obvious because of the dilution effect of rainy season. In some sampling points the values showed some sudden rise and then unexpected fall. This might be due to some clay, or organic matter have deposited in that discrete pockets.

The DO of the effluents varied from 0 .02 to 3.1 mg/L with average value 0.9 mg/L in dry season and 0.08 to 3.04 mg/L with average value 0.62 mg/L in wet season. Source point DO level observed less than 3 mg/L and less than 1 mg/L in dry and wet season respectively. It is found that most of the effluents samples contain 9 to 13 times lower DO than DOE standard (Table V11). Up to half of the sampling area (sampling point 5 to sampling point 11) DO value was near about 2 mg/L and in sampling point 11 DO value was more than 3 mg/L. The remaining sampling point (sampling point 12 to 20) DO concentration is very low towards the beel in dry season. The level of DO did not show source distance relationship (Fig.8). There are evident of abrupt change of DO level in dry season in the sampling point 11 and in wet season in the sampling point 16 and 17. Good quality of water contains DO value in between 4.5 to 8 (ECR, 1997). So in the studying area DO in water is very low. But oxygen is essential to all forms of aquatic life including those organisms responsible for the self purification process in natural waters. Like terrestrial animals, fish and other aquatic organisms need oxygen to live. The presence of oxygen in water is a positive sign of a healthy body of water and the absence of oxygen is a signal of sever pollution. Textile and dyeing mills release huge amount of BOD and COD wastes which consume the dissolved oxygen of water. Those effluents are being discharged into the DEPZ area. So the water of this area is harmful to aquatic life for the low value of DO. In the two seasons all the values were below the minimum standard mg/L. Do value less than 4 mg/L causes to kill fish and other flora and fauna of water kingdom. (Ahmed, et. al 2009).

Industries release a lot of biochemical oxygen demanding wastes. The BOD values of the effluents varied from 11 to 293 mg/ L and 2.4 to 251 mg/L in dry and wet season respectively. Average values are 77 and 96 mg/L in dry and wet season. Source point average values are 22.2 and 89.4 mg/L respectively. It is to be noted that in dry season from sampling point 11 to 20 BOD values are increasing than the above values. The highest biological oxygen demanding was 293 mg/L in sampling point 19 in dry season and sampling point 14 in wet season. It is also found that the BOD level was higher than the recommended level. The results shows that (Fig. 9) though the highest concentration of BOD found in dry season, but the average BOD concentration of effluent is higher in wet season. Similar type of high BOD concentration is also observed in the study of Ahmed 2009. He concluded this as surface water pollution from the organic waste of DEPZ industries.

Chemical oxygen demand (COD) is defined as the amount of a specified oxidant that reacts with the sample under controlled conditions which is one of the most important parameter for assessing the quality of chemically oxidizing matter in water. Textile industries release a lot of chemical oxygen demanding wastes. The COD values of the effluents varied from 3.8 to 202 mg/L and 7.4 to 450 mg/L respectively in both season. Average values were found 57.9 to 70.39 mg/L respectively. Source values were 11.7 to 35.7 mg/L respectively. There is an abrupt change observed in the COD level at the sampling point 19 in wet season. The average value of COD is lower than the recommended value 200 mg/L (table-VII). Source values were also lower than the recommended value. This lower value of COD is beyond our explanation, because there is a correlation between COD and DO value. When the COD value is higher the DO value will substantially lower because organic materials require a large amount of dissolve oxygen for their metabolism. The Lower DO value indicates higher organic waste pollution but lower COD indicate the reverse. The result has also conflict with the result of Ahmed, 2009. Source distance relationship of COD is not observed like other physicochemical parameters. This is an unexpected change observed in the COD level at the farthest sampling point from the source point during wet season. To explain this sudden change it is require further study.

The total alkalinity measured in the water of DEPZ area varied from 603 mg/L to 1139 mg/L in dry season and 44.8 mg/L to 489 mg/L in wet season. With an average 836 mg/L and 372 mg/L in dry and wet season respectively. Source point values are 1131 mg/L and 744 mg/L respectively. Remaining sampling point (sampling point 5 to 20) average values were less than source value. In every sampling point including source point concentration is several folds higher than the permissible limit. For fishing purpose maximum tolerable limit of alkalinity is 200 mg/L (Mowka and Edmund, 1988). Usually the value of alkalinity alters with pH. In some cases it alters because of buffer action (EQS, 2004). From the figure 11 it is evident that total alkalinity shows a strong seasonal variation. But in case of source distance relationship like other parameters it shows a sudden change in the sampling points 12 and 17 in dry season. This may be because of there a pocket has been created and effluents are accumulated there for long time. High level of alkalinity indicates that the water of this area is harmful for soil, crops, and vegetables (Ahmed. 2009). Alkalinity also gives an idea of nature of salts present in the water. According to (Mahfuz, et al 2007). When the alkalinity is equal to hardness calcium and magnesium salts are only present. But in the present study it observed that total alkalinity is several times higher than the total hardness which indicates that along with calcium and magnesium the basic salts such as sodium and potassium is also present there.

The total hardness in the effluent receiving water of DEPZ are varied from 62.4 mg/L to 133 mg/L and 59.9 to 150 mg/L in dry and wet season respectively. Average values were found 98.4 and 82.4 mg/L respectively. Source point values are 77.0 and 69.8 mg/L respectively. Source point values are several folds higher than the remaining sampling point average values (Sampling point 5 to 20). It might be due to some non point source as agricultural pollution or vehicles from the road sides. In dry season sampling point 11, 12 and 13 the hardness concentration was slightly higher than the other sampling point values. In wet season sampling point 15, 16, and 17TH sample point concentration was higher. Similar result of total hardness also observed in the study of (Ahmed, et al 2009), where the value of total hardness was higher around 1500m away from the point source.

Correlation analysis among the physicochemical parameter

Pearson correlation also indicated the relationship between this physicochemical parameter. In dry season temperature and DO showed positive statistical correlation. EC showed statistical correlation with TDS and salinity (Table VI). The correlation in dry season has shown in details in table VI. It is evident that all the parameters are somehow statistically correlated with some of the others parameters. However the degree of correlation is varied with parameter to parameter. In wet season the degree of Pearson correlation varied from wet season. For example in dry season temperature is correlated with two other parameters but in wet season temperature is correlated with three parameters (Table VI). Moreover, the degree of correlation is also varied within the samples parameters.

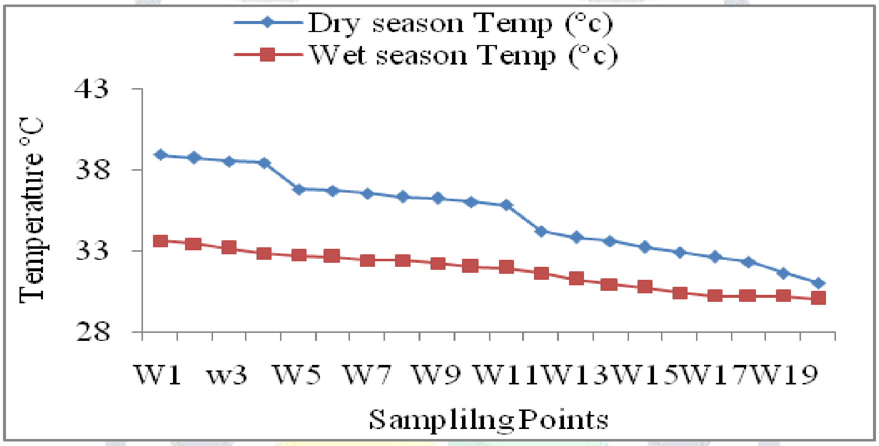

Figure.1: Variation of temperature in different sample points in dry and wet seasons

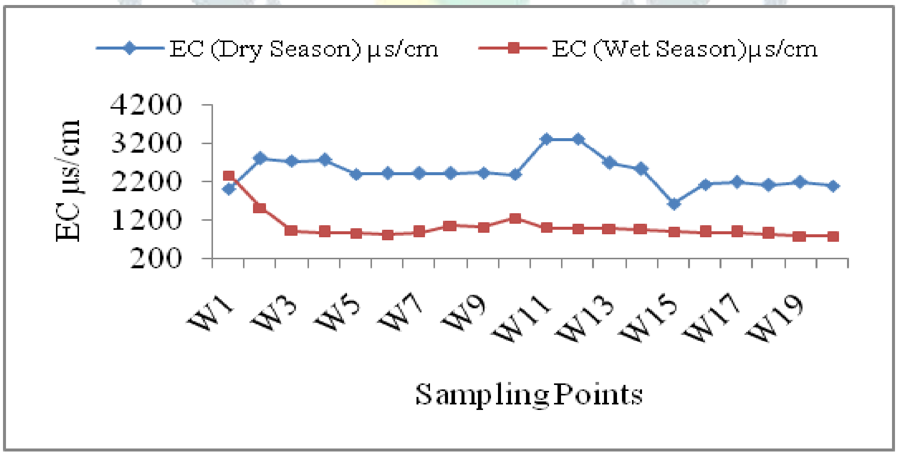

Fig 2: Variation of EC at different sample points in dry and wet seasons

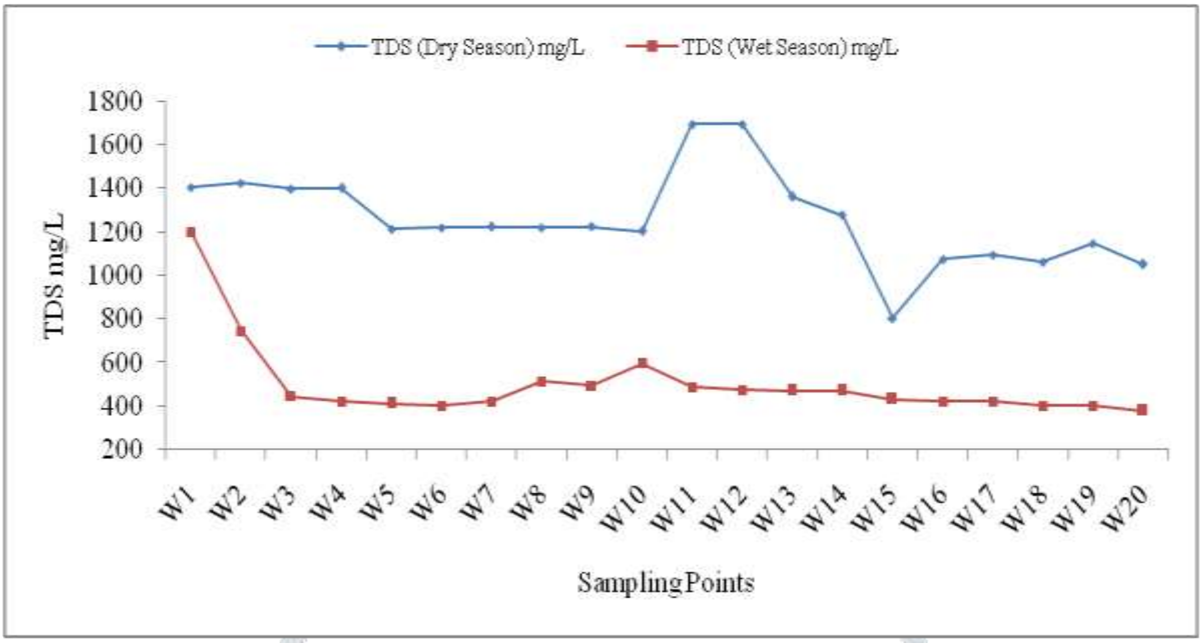

Fig 3: Variation of TDS at different sample points in dry and wet seasons

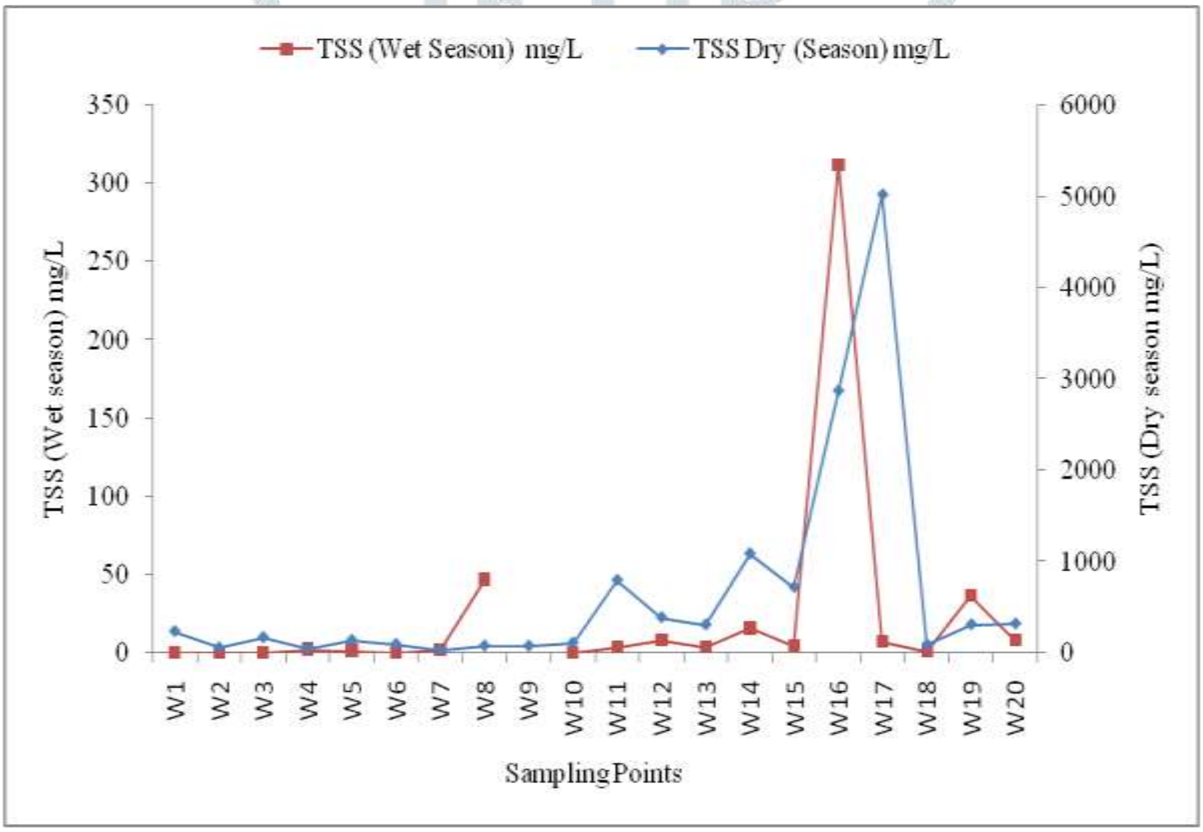

Fig 4: Variation of TSS at different sample points in dry and wet seasons

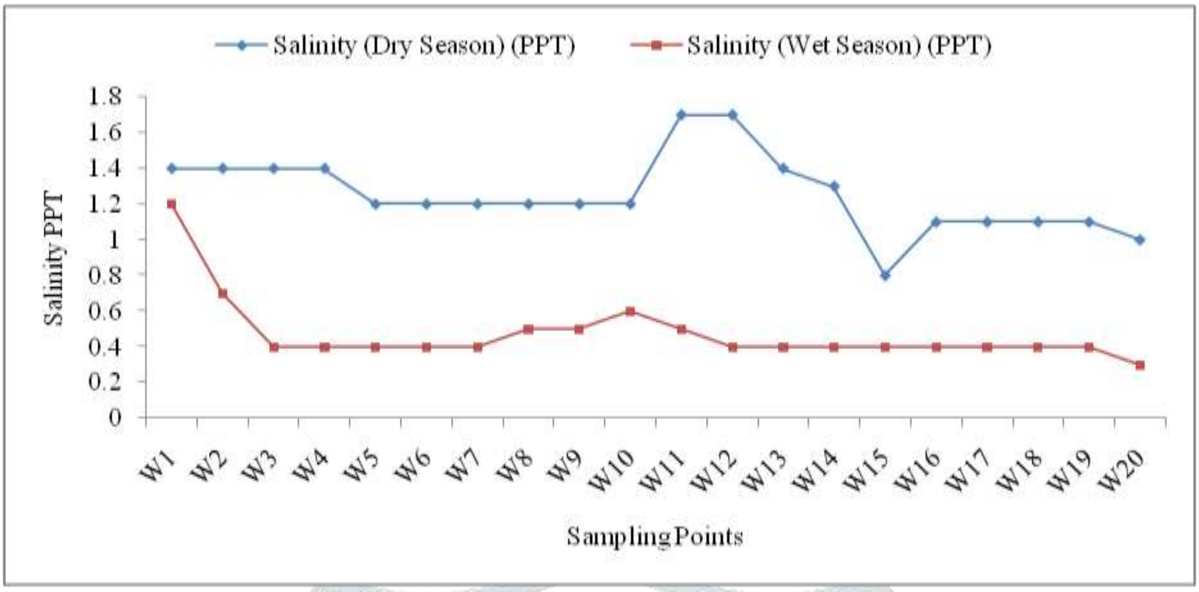

Fig. 5: Variation of Salinity at different sample points in dry and wet seasons

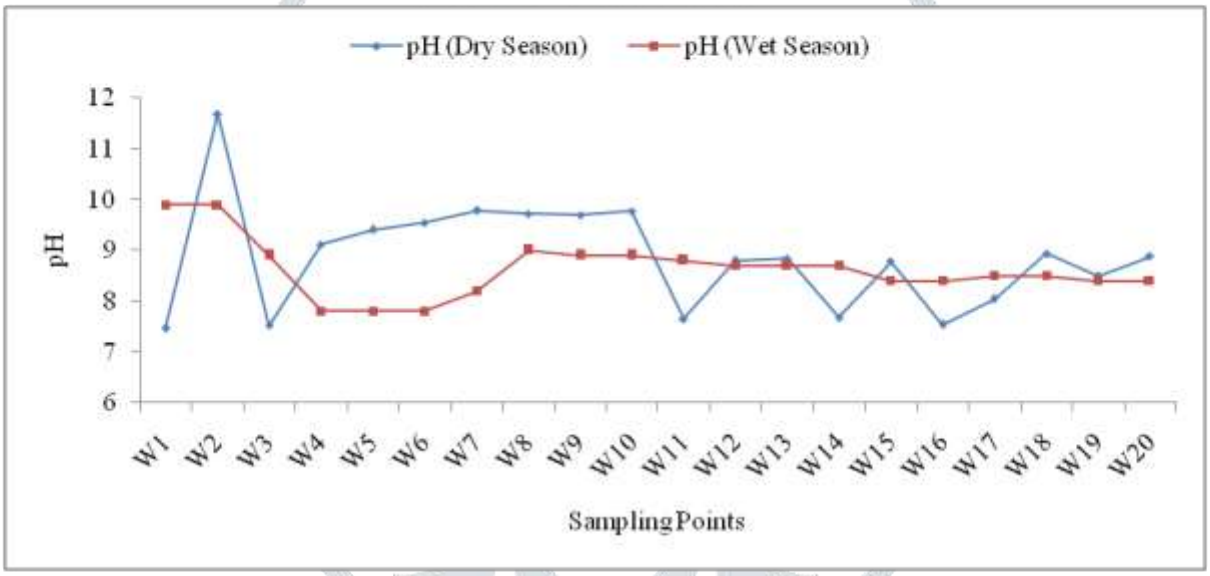

Fig. 6: Variation of PH at different sample points in dry and wet season

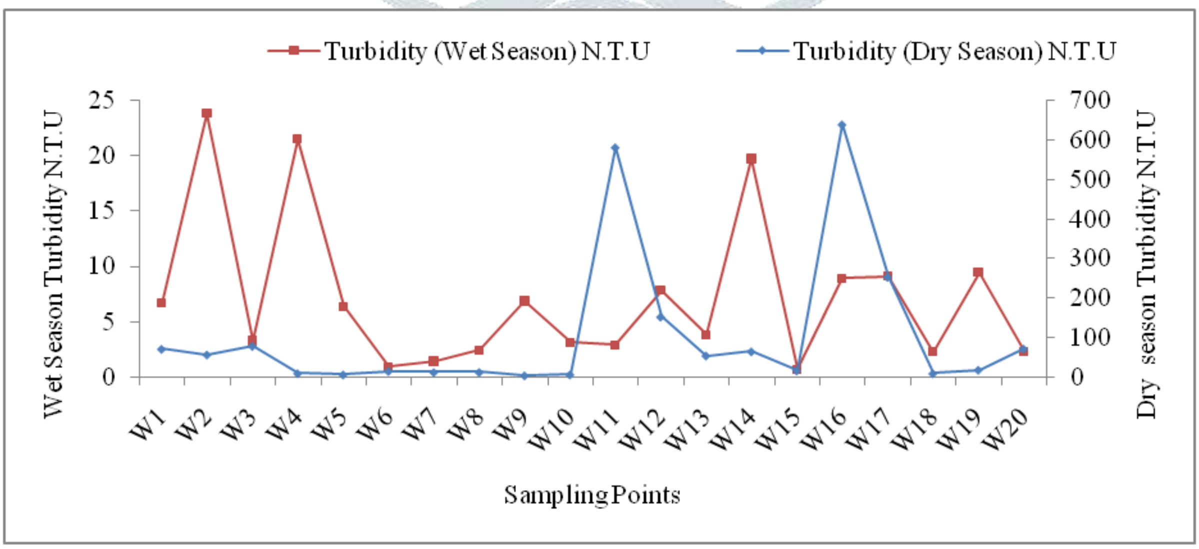

Fig. 7: Variation of Turbidity at different sample points in dry and wet seasons

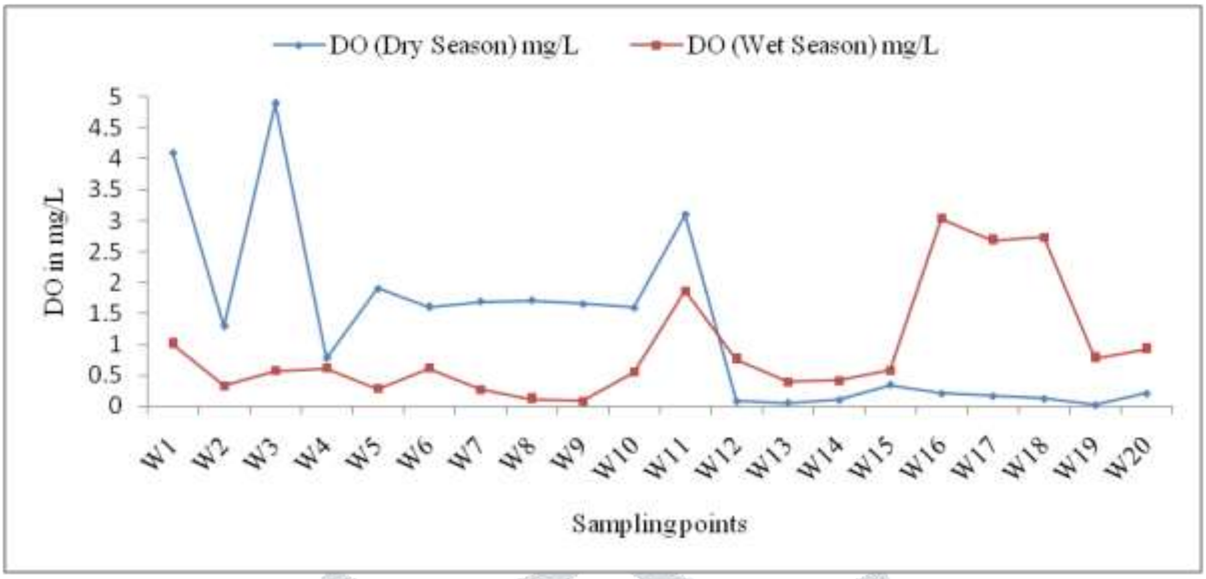

Fig. 8: Variation of DO at different sample points in dry and wet seasons

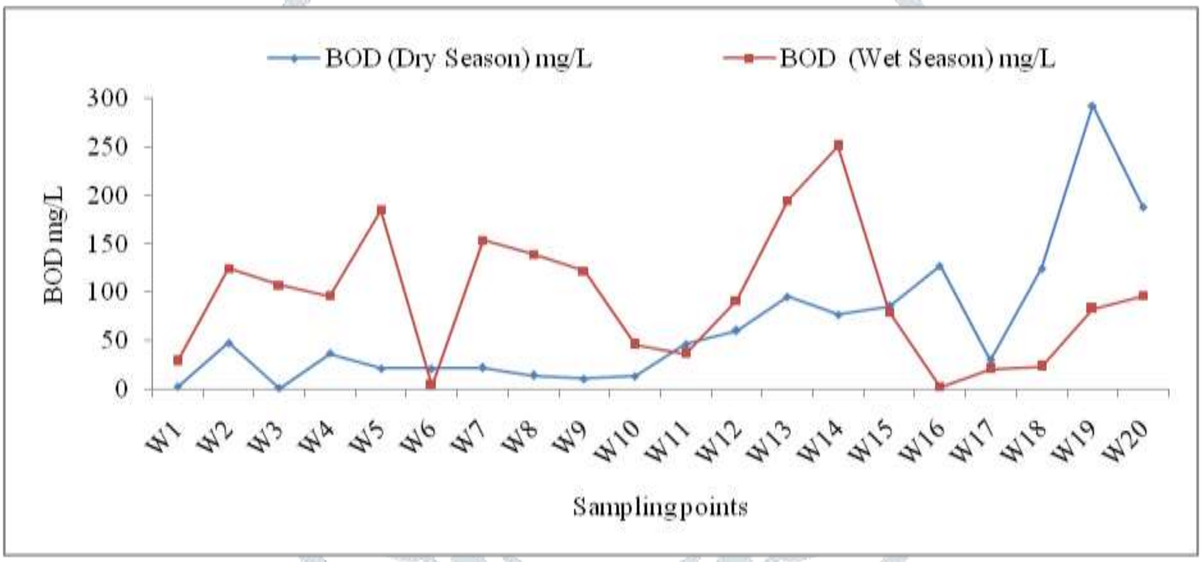

Fig. 9: Variation of BOD at different sample points in dry and wet seasons

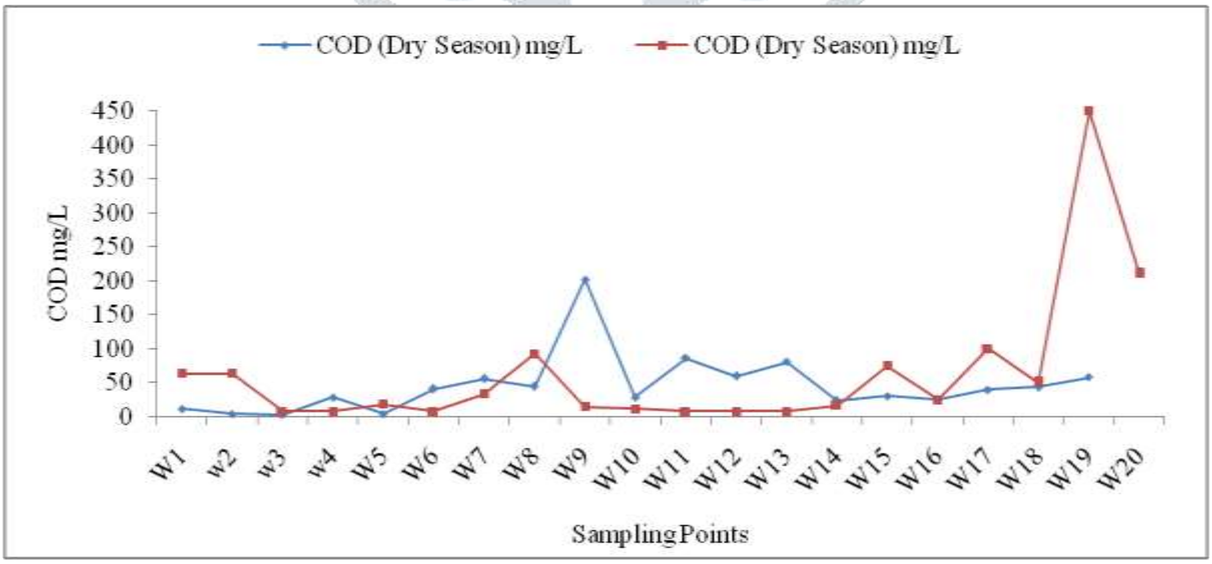

Fig. 10: Variation of COD at different sample points in dry and wet seasons

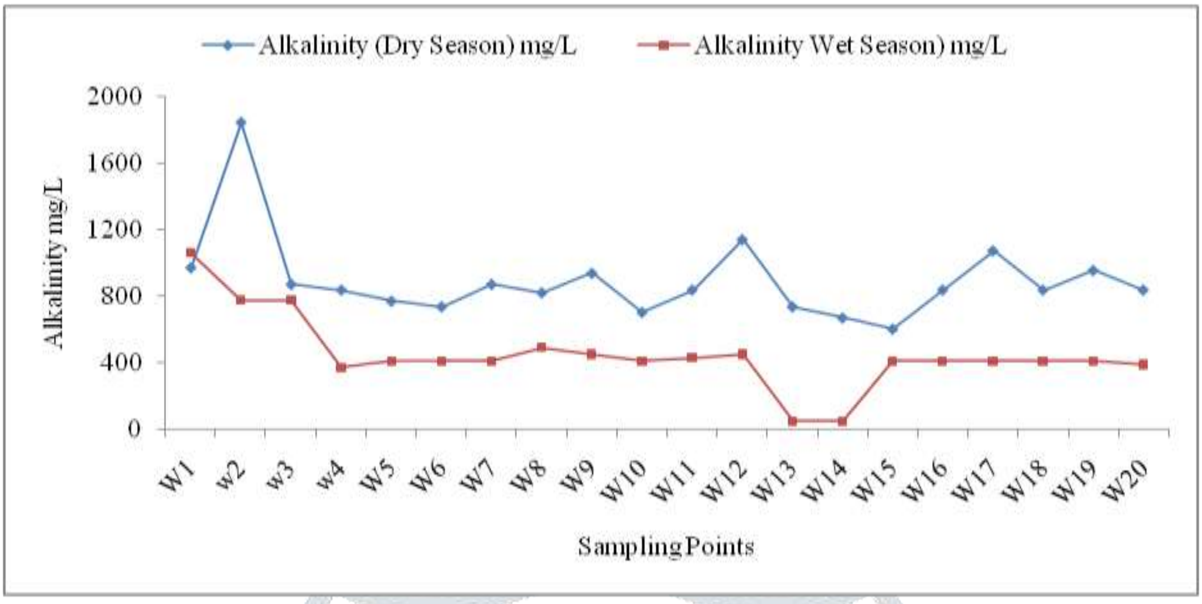

Fig. 11: Variation of Alkalinity at different sample points in dry and wet seasons

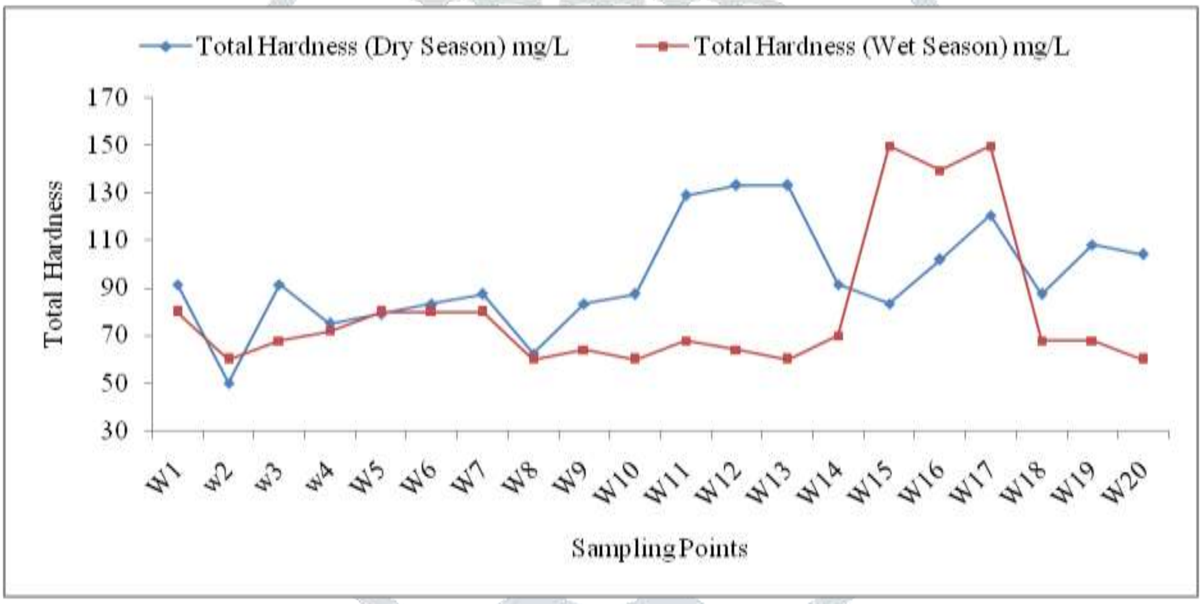

Fig12: Variation of total hardness at different sample points in dry and wet seas

Table VI: Correlation among the physic-chemical parameter of water in dry season

	Temp (°c)	EC	TDS	TSS	Salinity	pH	Turbi dity	DO	BOD	COD	Alkalinity	Total Hard
Temp	1											
EC	.390	1										
TDS	.418	.992**	1									
TSS	-.380	-.185	-.201	1								
Salinity	.398	.989**	.993**	-.162	1							
pH	.505*	-.117	-.122	-.622**	-.168	1						
Turbidity	-.159	.300	.283	.564*	.315	-.741**	1					
DO	.861**	.388	.419	-.334	.381	.322	.077	1				
BOD	-.784**	-.308	-.279	-.001	-.297	-.384	.058	-.602*	1			
COD	.036	.236	.206	-.161	.185	.181	-.012	.098	-.065	1		
Alkalinit y	.087	.369	.430	.240	.402	-.072	.146	.079	.003	.166	1	
Total Hard	-.453	.495*	.470	.361	.493*	-.558*	.491*	-.354	.310	.189	.289	1

	Temp (°c)	**EC**	**TDS**	**TSS**	**Salinity**	**pH**	**Turbidity**	**DO**	**BOD**	**COD**	**Alkalinity**	**Total Hard**
Wet Season												
Temp	1											
EC	.301	1										
TDS	.577*	.497*	1									
TSS	-.275	-.084	-.143	1								
Salinity	.629**	.507*	.943**	-.110	1							
pH	.093	.555*	.748**	-.038	.656**	1						
Turbidity	-.065	-.094	.314	.175	.185	.291	1					
DO	-.574*	-.258	-.274	.509*	-.192	-.065	.031	1				
BOD	.210	.099	.068	-.289	-.101	.088	.354	-.670**	1			
COD	-.493*	-.421	-.309	-.004	-.273	-.099	.059	.007	-.080	1		
Alkalinity	.399	-.138	.412	.027	.529*	.159	-.135	.085	-.514*	.084	1	
Total Hard	-.377	-.268	-.286	.433	-.238	-.287	.020	.514*	-.382	-.032	.066	1

** Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table VII: DOE stander values of some physical parameters (Bangladesh, ECR 1997)

Parameter	Inland surface water
Temperature	40^0c
Electrical conductivity	1200
TDS	2100
TSS	150
Salinity	
P^H	6-9
Turbidity	20 NTU
DO	4.5-8
BOD	50
COD	200
Alkalinity	200
Total hardness	300 mg/l

CONCLUSION

The results of the physicochemical characteristics of surface water body connected to the disposal sites of DEPZ specify that they contain a massive amount of color suspended and dissolve organic dyes and inorganic species. The discharge process is continuous; therefore surface water body is entirely burden with these pollutants. In addition the effluents of different kinds of industries, especially textile and dyeing industries are mainly responsible for this impact. In the present study two season dry season and wet season were studied and compared to each other. In this study detected higher electrical conductivity (EC), TSS, Turbidity and alkalinity concentration in dry season exceeded several times than DOE standard. High EC values water should not be used for irrigation of crops and vegetables. Contamination levels of the parameters were relatively higher in the dry season than that in the wet season. Total study area was around one and half kilometer area. From the source point to half kilometer of the area (sampling point 5 to 12) maximum physicochemical parameter concentration was higher. After this area consecutive sampling area (nearly 0.75 Km area) physicochemical parameter concentration was lower. Especially sampling points 11 and 12 this 200m area concentration was higher than the others because there was a pocket area. As a whole the result of this study have showed that the surface water around DEPZ up to 0.75 km area was highly impacted due to continuous mixing of the effluents and is quite unsuitable but remaining 0.75 km area is quite suitable to serve aquatic and agricultural purpose.

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