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An Assessment of the River Water Quality Parameters: A case of Jamuna River

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Abstract: River water quality is a key concern as it is used for drinking and domestic purpose, irrigation and aquatic life including fish and fisheries. The Jamuna River is one of the most prominent central rivers in Bangladesh as well as it represents the tapestries line of our riverine country. The river can play a vital role to contribute social economic structure of development as a developing country like Bangladesh. The study was conducted to assess the physical and chemical water quality parameters of Jamuna River. The water samples were collected in plastic container of 2 liters capacity from five different geographic locations along the river in 2012-2013 during both dry and wet season. And 25 numbers of samples were collected from surface and 2 feet below from the surface of water at different selective sampling points. A number of physiochemical water quality parameters including Temperature, pH, EC, TDS, DO, BOD, COD, Nitrate (NO^{2-} and NO^{3-}), Ammonia, Sulphates, Chlorides, and Calcium were measured in laboratory base analysis. The mean value of such respective parameters in both season were compared with the water quality standards as set by the EQS guideline, ADB, and the guideline of Department of Environment (DoE) in Bangladesh.

Key Words: Dry season, Jamuna River, Physiochemical variables, Wet season

Introduction

Water has become an essential commodity for the development of industrials and agriculture (Kudesia, 1990). Water is absolutely essential not only for survival of human beings, but also for animals, plants and all other living things (Razo *et al.*, 2004). Water is also crucial for the quality of life. The oceans, the rivers, lakes and creeks together with the land constitute the canvas on which life grows and interacts. The ecological balance maintained by the quantity and quality of water determines the way of life of a people. On the other hand, polluted water is the greatest source of disease and besides debasing the land also becomes unfit to sustain life (Francis, 1994). Today the problem is not only of water availability but of environmental quality and ecological balance. With increasing industrialization, urbanization and technological advance in all fields, sources of water are getting more and more seriously polluted. The survival of life on earth will be threatened if the present rate of pollution continues unabatedly. Natural waters are afflicted with a wide variety of inorganic, organic, and biological pollutants. In some cases, such as that of highly toxic cadmium, a pollutant is directly toxic at a relatively low level. In other cases, the pollutant itself is not toxic, but its presence results in conditions detrimental to water quality. For example, biodegradable organic matter in water is often not toxic, but the consumption of oxygen during its degradation prevents the water from supporting fish life (Trivedi, 1992). pH must be controlled within a range favorable to the particular organisms involved. Chemical processes used to coagulate sewage or cyanide ion require that the pH be controlled within rather narrow limits (Nahar, 2000). The fluctuation in river water temperature usually depends on the season, geographic location, sampling time and temperature of effluents entering the stream (Ahipathy, 2006). For public health, chlorides up to 250 mg l^{-1} are not harmful but values gather than this are indication of organic pollution (Nahar, 2000). Oxygen is the single most important gas for most aquatic organisms; free oxygen (O_2) or DO is needed for respiration. DO levels below 1 ppm will not support fish; levels of 5 to 6 ppm are usually required for most of the fish population. The average value of DO levels (6.5mg/l) indicates the average quality of river water (APHA, 1995). The important water quality parameters such as, Color, Odor, Temperature, pH, TSS, TDS, TS, BOD, COD, DO, Turbidity, EC and Salinity.

Industrial effluents of different origins containing toxic metals, pesticides, etc and anthropogenic sources (Hatje, *et al.*, 1998) create water pollution problems through discharges into river water. The utility of river water for various purposes is governed by physico-chemical and biological quality of the water. The assessment of the changes in river communities as a result of the impact of pollution is particularly interesting issue within the frame work of aquatic ecology, since running waters are becoming increasingly affected by anthropogenic discharge (Whitton *et al.*, 1991). Many workers have studied the impact of anthropogenic activities on the environmental conditions (Kang *et al.*, 2004; Shirodkar *et al.*, 2010; Bhardwaj *et al.*, 2010).

Industrial pollution is one of the major types of water pollutions, as water is an essential raw material in almost all manufacturing plants. Industries that are considered as principal sources of pollution are chemicals, foods, pharmaceuticals, materials and energy. The increased application of commercial fertilizer and widespread use of variety of a new pesticides, insecticides, herbicides and weed killers in agricultural practices are resulting in a host of new pollution problems from land drainage. This type of agricultural pollution has severe impact on water Pollution, as most of pollutants are resistant to natural degradation. Although concentration of the pollutants are still rather low, many of this compounds are toxic to human or animal life; some of them are carcinogenic or have serious ecological implication. (Davis, *et al,* 1998; APHA, 1995; Peavy, *et al,* 1985; Sawyer, *et al*., 1994). Irrigated agriculture is dependent on adequate water supply of usable quality. Water quality concerns have often been neglected because good quality water supplies have been plentiful and readily available (Shamsad and Islam, 2005; Islam *et al.,* 1999). This situation is now changing in many areas. Intensive use of nearly all good quality supplies means that new irrigation projects, and old projects seeking new or supplemental supplies, must rely on lower quality and less desirable sources (Cuena, 1989).

Irrigation water quality is related to its effects on soils and crops and its management. High quality crops can be produced only by using high-quality irrigation water keeping other inputs optimal. Characteristics of irrigation water that define its quality vary with the source of the water. There are regional differences in water characteristics, based mainly on geology and climate. There may also be great differences in the quality of water available on a local level depending on whether the source is from surface water bodies (rivers and ponds) or from groundwater aquifers with varying geology, and whether the water has been chemically treated. The chemical constituents of irrigation water can affect plant growth directly through toxicity or deficiency, or indirectly by altering plant availability of nutrients (Ayers and Westcot, 1985; Rowe *et al.,* 1995).

To evaluate the quality of river water for the purpose of irrigation, health, domestic and fisheries, we need to identify the physiochemical characteristics that are important for respective field, and their acceptable levels of concentrations.

Materials and Methods

Study Area

The study was conducted between the Govindashi Ghat, Bamonhata, Nalin Bazar, Langra Bazar area at Bhuapur Upazila and Gabsarachar Punglipara (Chars of Jamuna River).

Sampling procedure

The 250 ml plastic bottles were washed well and rinsed with 1-2 ml 2% industrial HCl. The bottles were rinsed again with sampled water and the water samples were collected securely and sealed with proper labeling. Aeration during sampling was avoided as far as possible. The water samples were carefully transported to the laboratory and are preserved for physical and chemical analysis. Samples were collected from river in the distance of about 100 meter from one sample to another.

pH

Procedure

First pH meter was standardized by distilled water and buffer solution. Then 50 ml of sample was taken in clean 100 ml plastic beaker and immersed the pH meter and waited for at least five minutes. Then pH reading was collected from pH meter and wrote down in the notebook. In the same way, for all other samples pH was measured but before every measurement pH meter was sank into distilled water or buffer solution.

EC, TDS and Temperature

Procedure

Firstly conductivity TDS meter electrode was washed out by distilled water. And then the cell constant of the conductivity meter was checked. Twenty ml sample was taken in 50 ml measuring cylinder and immersed the electrode and waited for at least 10 seconds.Then Electrical Conductivity (EC), Total Dissolved Solid (TDS) and Temperature readings were collected from this meter and wrote down in the notebook.

DO (Dissolved Oxygen)

Procedure

First DO meter was standardized by distilled water and buffer solution. Then 50 ml of sample was taken in clean 100 ml plastic beaker and immersed the DO meter and waited for at least five minutes. Then DO reading was collected from DO meter and wrote down in the notebook. In the same way, for all other samples DO was measured but before every measurement DO meter was sank into distilled water or buffer solution.

BOD (Biological Oxygen Demand)

Procedure

The Biochemical Oxygen Demand (BOD) of polluted water is the amount of oxygen required for the biological decomposition of dissolved organic matter. Usually, the time is taken as 5 days and the temperature 20°C as per the global standard. The BOD test is among the most important method in sanitary analysis to determine the polluting power, or strength polluted water. It serves as a measure of the amount of clean diluting water required for the successful disposal of sewage by dilution. The test has its widest application in measuring waste loading to treatment plants and in evaluating the efficiency of such treatment systems. The test consists in taking the given sample in suitable concentrations in dilute water in BOD bottles. Two bottles are taken for each concentration and three concentrations are used for each sample. One set of bottles is incubated in a BOD incubator for 5 days at 20°C; the dissolved oxygen (initial) content (D_1) in the other set of bottles will be determined immediately. At the end of 5 days, the dissolved oxygen content (D_2) in the incubated set of bottles is determined.

COD (Chemical Oxygen Demand)

Procedure

COD results are reported in terms of mg of oxygen. N/8 or 0.125 N solution of oxidizing agent is used in the determination. Normality double the strength is used. This allows the use of larger samples. Thus, each ml of 0.25 N solution dichromate is equivalent to 2 mg of oxygen. An excess of oxidizing agent is added, the excess is determined by another reducing agent such as ferrous ammonium sulphate. An indicator ferroin is used in titrating the excess dichromate against ferrous ammonium sulphate. Blanks are used also treated and titrated to get the correct value of COD.

Nitrate (NO^{2-} and NO^{3-})

Procedure

The reaction with the nitrate and brucine produces yellow color that can be used for the colorimetric estimation of nitrate. The intensity of color is measured at 410 nm. The method is recommended only for concentration of 0.1– 2.0 mg/l. All strong oxidizing and reducing agent interfere. Sodium arsenide is used to eliminate interference by residual chlorine; sulphanilic acid eliminates the interferences and chloride interference is masked by addition of excess NaCl. High concentration of organic matter also may interfere in the determination.

***Ammonia** .*

Procedure

To a 100mL sample, add a little NAOH to neutralize the acid used for storage and then add 1 ml 10% $ZnSO_4$. $7H_2O$ followed by 1 ml 10% NAOH. Stir and filter. (Ca, Fe, Mg, $S2^-$ are Precipitated). Collect the colorless middle fraction, and 1 drop of 50% EDTA mix well and 2 ml of Nessler's reagent ($70gKI+160HgI_2+160gNaOH$ diluted to I liter). Shake well. Measure the resulting yellow color at 420nm. When the sample is colored, distil a 500mL sample with dil. NaOH and collected the distillate in an Erlenmeyer flask containing 200 ml of 0.1 N H_2SO_4.. Make up the volume of distillate to 250ml in a volumetric flask. Take 5-10 ml aliquot, neutralize with 0.1N NaOH to pH 4-5, and add 2 ml nessler's reagent .Proceed as above for measurement. Distil as above and collect only 100 ml of the distillate in an Erlenmeyer flask. Titrate with 0.02 N H_2SO_4, using a mixed indicator (200 mg methyl red in 100 ml 95% ethyl or isopropyl alcohol + 100 ml methylene blue in 50 ml 95% ethyl alcohol), until the indicator turns a pale lavender. Carry a blank through all the steps.

Sulphates

Gravimetric Method with Ignition of Residue

Sulphate is precipitated in hydrochloric acid medium as barium sulphates by the addition of barium chloride. The precipitation is carried out near the boiling temperature and after a period of digestion the precipitate is filtered; washed with water until free of chlorides, ignited and weighed as barium sulphates.

Chlorides

Procedure

If water containing chlorides is titrated with silver nitrate solution, chlorides are precipitated as white silver chloride.

Potassium chromate is used as indicator, which supplies chromate ions. As the concentration of chloride ions Approaches extinction, silver ion concentration increases to a level at which reddish brown precipitate of silver chromate is formed indicating the end point.

Calcium

Procedure

To a 100 ml sample add sufficient KOH (20%) solution to bring the pH to about 12 and precipitate Mg^{2+} as $Mg(OH)_2$.Add 5-10 drops of calconcarboxylic acid indicator (0.4% in methanol) and titrate underMagnetic stirring with 0.05M EDTA solution till the color changes from wine-red to paleblue. Alternatively, add 5 drops of murexide indicator (0.1g stirred with 2.5 ml Deionised water and filtered) and titrate with 0.05M EDTA solution till the color changesfrom orange to violet.

Data Processing and Analysis

The relevant data were processed and analyzed through manually and for computer based analysis MS Excel of Office 2007 version was used.

Results and Discussions

Physical Parameters

pH

The higher values of pH represent that there is high chloride, bicarbonate, carbonate etc. that means the water is alkaline. In Jamuna river water there is a significant variation of pH in various sampling station in both seasons (Table 01).pH of the water samples ranged from 8.0 to 9.1 (in dry season) and 8.4 to9.3 (in wet season). In pH average value of samples were found 8.63 and 8.9 where the standard value 7.25 and the standard deviation is 0.98 in dry season and 1.17 in wet season (Table 01).the permissible limit of p^H for irrigation: 6.0 −8.4 (Ayers and Westcot, 1985), 6.5 −8.5 (FAO, 1992), 6.0–8.5 (ADB, 1994) or 6.0 – 9.0 (GOB, 1997).

Table 1. Comparison the physical parameters of Jamuna River water during dry and wet season

Parameter	**Dry season**		**Wet season**		**Standard (DOE, 2001)**	**Bangladesh Standard for Fisheries (EQS,1997)**	**Domestic Standards (De, 2005)**	**Drinking Standards (ADB ,1994)**	**Irrigation standard (Ayers and Westcot 1976)**
	Avg. (N=5)	Mean± SD (N=25)	Avg. (N=5)	Mean±SD (N=25)					
pH	8.8	8.6±0.98	9.1	8.9±1.17	7.25	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
	8.7		8.9						
	8.4		8.6						
	8.6		8.9						
	8.8		9.0						
Temperature (°C)	32.5	32.59± 1.48	35.8	35.93±3.84	30.5	25			
	32.5		35.9						
	32.5		35.9						
	32.7		35.9						
	32.8		36.1						
EC (µS/cm)	137.2	137.83 ±114.67	107	107.70±135.98	300	800-1000 (µs/cm)	NA	NA	750
	137.6		107						
	138.2		106.4						
	138		105.4						
	138.3		105						
TDS (ppm)	130	130.04 ±24.72	109	109.48±39.26	165	500	500	1000	< 450
	129.6		109.8						
	130.6		109.6						
	130.4		110						
	129.3		109						
DO (ppm)	0.96	1.01±3.88	0.3	0.45±4.28	6.5	4.0-6.0 (mg/I)	4.0-6.0	NA	NA
	1.06		0.6						
	1.1		0.3						
	0.8		0.4						
	1.1		0.8						
BOD (ppm)	33	34.26± 20.69	52.6	59.04±38.21	5.0	(-) or below 2 (mg/I)	NA	NA	NA
	33.8		49						
	32.4		50.8						
	34.4		54.4						
	40		56						

Temperature

Temperature of water may not be as important in pure water because of the wide range of temperature tolerance in aquatic life, but in polluted water, temperature can have profound effects on dissolved oxygen (DO) and biological oxygen demand (BOD). The fluctuation in river water temperature usually depends on the season, geographic location, sampling time and temperature of effluents entering the stream (Ahipathy, 1995). In Jamuna River different temperatures in various sampling stations during both season (Table 01).The temperature of water samples varies from 32.3 to 33.0 ^{0}C (in dry season) and 34.5 to 36.6^{0}C (in wet season). The suitable temperature range of water for irrigation is 20–30^{o}C (GOB, 1997).

EC

Its value depends on the concentration and degree of dissociation of the ions as well as the temperature and migration velocity of the ion in the electric filed. The electrical conductivity measures the concentration of ions in water. The concentration of ions depends on the environment, movement and sources water. The soluble ions in the surface water originate primarily from solution of rock materials. Specific conductance of most natural water generally ranges from about 50 to 1500 µS/cm.The Electric Conductivity in the study area ranged between 135 to 141 µS/cm in dry season and 104 to 109 µS/cm in wet season (Table 01) most of which is lying within standard level of EC of most natural waters. The average and standard of EC showed a significant standard deviation.The recommended threshold (TV) EC is 0.70 dS m−1(FAO, 1992), 0.75 dS m−1(ADB, 1994) or 1.2 dS m−1 (GOB, 1997).

TDS

Total Dissolve Solids (TDS) refers to the sum of all the components dissolved in water. In natural water dissolved solids are composed of mainly Na^+, K^+, Ca^{2+}, Mg^{2+}, and Cl^-, $SO4^{2-}$, $PO4^{3-}$, $H_4SiO_4^{2-}$, and HCO_3^-. Water that contains too much dissolve matter is not suitable for common uses.TDS in the study area varies from 129 to 131 ppm in dry season and 106 to 111 ppm in wet season (Table 01).Comparison between average value and standard value shows a small variation and the field value is less than the standard value (Table 01) so the river water is moderately suitable for common uses.

Table 2. Comparison the chemical parameters of Jamuna River water during dry and wet season

Parameters	**Sampling site**	**Dry season**		**Wet season**		**Standard (DoE, 2001)**
		Avg (N=5)	Mean±SD (N=25)	Avg (N=5)	Mean±SD (N=25)	
COD (ppm)	1	97	98.30±66.68	9.8	8.9±3.46	4.0
	2	101.6		8.6		
	3	94.8		9.2		
	4	98.8		8.8		
	5	100		8.3		
Nitrate (ppm)	1	86.2	88.04±62.18	86.6	84.83±59.91	0.1
	2	89.6		87.6		
	3	83		84.6		
	4	94.8		94.4		
	5	85.7		91.3		
Ammonia (ppm)	1	11	11.22±7.58	2.4	2.7±1.87	0.05
	2	11		2.7		
	3	10.8		2.3		
	4	12		3.1		
	5	11.38		3.2		
Sulphate (ppm)	1	833	832.43±411.84	730.4	729.69±500.41	22
	2	831.6		731.6		
	3	834.6		730.6		
	4	830.6		726.6		
	5	832.3		729		
Chloride (ppm)	1	960.4	962.435±03.76	860.4	865.45±602.77	13
	2	969.4		873.4		
	3	961.8		865.8		
	4	960.4		862.4		
	5	958.7		865.3		
Calcium (ppm)	1	250	250.17±106.19	247.8	248.44±150.22	36
	2	251.8		284.8		
	3	250.4		249.4		
	4	250.6		249.2		
	5	246.7		247		

DO

Oxygen is the single most important gas for most aquatic organisms; free oxygen or DO is needed for respiration. The DO levels below 1 ppm will not support fish; levels of 5 to 6 ppm are usually required for most of the fish population. The average value of DO levels (6.5mg/l) indicates the average quality of river water (APHA, 2005). DO values in our study varied between 0.5 to 1.5 ppm in dry season and 0.1 to 1.1 ppm in wet season (Table 1**)**. The average value of DO is 1.01 ppm in dry season and 0.45 ppm in wet season where as the standard value is about 6.5 ppm. So comparison between average value and standard value of DO is highly deviated (Table 01) so that it represents the lower quality of river water for fish life and other aquatic life.

BOD

Unpolluted, natural waters will have a BOD of 5 mg/l or less. BOD directly affects the amount of dissolved oxygen in rivers and streams. The greater the BOD, the more rapidly oxygen is depleted in the stream. This means less oxygen is available to higher forms of aquatic life. The consequences of high BOD are the same as those for low dissolved oxygen: aquatic organisms become stressed, suffocate, and die. Sources of BOD include leaves and woody debris; dead plants and animals; animal manure; effluents from pulp and paper mills, wastewater treatment plants, feedlots, and food-processing plants; failing septic systems; and urban storm water runoff.

In present study BOD values varied between 20 to 43 ppm in dry season and 40 to 64 ppm in wet season (Table 01**)**.In Comparison between average value and standard value of BOD is showed higher deviation (Table 01) it refers to the lower quality of the river water i.e. the higher rate of pollution of water, it refers that the higher the deviation the lower the quality of water for fish and other aquatic life. ADB (1994) and GOB (1997) proposed BOD of 10 mg l^{-1} in irrigation water quality standards for Bangladesh.

Chemical parameters

COD

The measure of COD determines the quantities of organic matter found in water. This makes COD useful as an indicator of organic pollution in surface water (King *et al.*, 2003 and Faith, 2006). In the conjunction with the BOD test, the COD test is helpful in indicating toxic conditions and the presence of biologically resistant organic substances (Sawyer *et al.*, 2003). In present study COD values varied between 86 to 112 ppm in dry season and 8 to 10 ppm in wet season (Table 02**)**.Comparison between average value and standard value of COD in dry season shows higher deviation refers to the lower quality of the river water i.e. the higher amount of organic compounds in water which demands higher COD and as a result the lower quality of water for fish and other aquatic life. Where as in wet season it shows moderate values it refers moderate quality of water (Table 2).

Nitrate ($NO2^-$ and NO^{3-})

Nitrate concentration is low in fresh domestic wastewater but in the effluent of nitrifying biological treatment plants nitrate may be found in concentrations of up to 30 mg. In present study Nitrate (NO^{2-} and NO^{3-}) concentration of sample water ranges from 78 to 98 ppm in dry season and 77 to 99 ppm in wet season, this is very high in respect to standard value (Table 02). Comparison between the average value and standard value of Nitrate (NO^{2-} and NO^{3-}) is shown higher deviation (Table 02) refers to the lower quality of the river water i.e. the higher amount contamination from fertilizers, municipal wastewaters, feedlots, septic systems in water which causes higher concentration of Nitrate (NO^{2-} and NO^{3-}), it refers that the higher the deviation the lower the quality of water for fish and other aquatic life and for common uses. FAO (1992) recommended threshold value (30 mg l^{-1}).

Ammonia

It represents the presence of fecal matter from latrine. In present study Ammonia concentration of sample water ranges from 8 to 13 ppm in dry season and 2.1 to 3.3 ppm in wet season, this is very high in respect to standard value (Table 02).Comparison between average value and standard value of Ammonia is shows higher deviation (Table 02) that refers to the lower quality of the river water i.e. the higher amount organic matter content.

Table 3. Comparison the average value of Nitrate and Ammonia with their standard value

Parameter	Average Value		Standard (DoE, 2001)
	Dry	Wet	
Nitrate (ppm)	88.04	84.83	0.1
Ammonia (ppm)	11.22	2.7	0.05

Sulphate

Effluents from certain industries may also be a major source of sulphate of receiving waters. Another significant source to water systems is airborne industrial pollutants containing oxides of sulphur, which convert to sulphuric acid in precipitation (acid rain). Sulphate can also be produced by bacterial or oxidizing action as in the oxidation of organo-sulphur compounds. The more common sinks are pyrite, gypsum, and sulphate reduction. The generalized formula for sulphate reduction is: $SO_4^{2-} + 2CH_2O \rightarrow 2HCO_3^- + H_2S$ Sulphate concentrations in study area ranged between 824 to 843 ppm in dry season and 712 to 743 ppm in wet season (Table 02).Comparison between average value and standard value of Sulphate is shown the higher deviation (Table 02) refers to the lower quality of the river water, unsuitable for common uses and aquatic life.

Chloride

Chloride is an indication of salinity in water. Surface water containing significant amount of chloride also tend to have high amount of Na ions indicating the possibility of contacts with water of marine origin. From an environmental standpoint, chloride is basically a conservative parameter and may serve as an index of pollution occurring in natural freshwater from primary sources such as industrial and municipal outlets. The chloride concentrations in the study area of both seasons are presented. Chloride content of samples ranged between 950 to 976 ppm in dry season and 850 to 891 ppm in wet season (Table 2).Comparison between average value and standard value of Chloride is shown the higher deviation (Table 2) refers to the higher impurity of the river water which is unsuitable for common uses and aquatic life.

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Calcium

The calcium concentrations in study area ranged between 243 to256 ppm in dry season and 243 to 255 ppm in wet season (Table 2).Comparison between average value and standard value of Calcium is shown the higher deviation (Table 2) refers to the higher impurity of the river water which is unsuitable for common uses and aquatic life. Almost all the samples in the study area showed high concentration of calcium that means those concentration falls out of range of natural freshwater. This high concentration may be due to primarily domestic discharges into theriver, and the presence of CO_2 which cause $CaCO_3$ to dissolve.

Evaluation of surface water for irrigation purposes

Irrigation water criteria depend on both the chemical composition and the nature of plants to be irrigated, soil type, climate, amount and method of irrigation and drainage. The suitability of water for irrigation can be determined by the amount and kinds of present salt as well as the soil texture and the salt tolerance of crop. The suitability of surface water for irrigation is restrictive on the effects of mineral constitutes of water on both the plant and soil. Excessive amount of dissolved ions in irrigation water affects plants and agricultural soil physically and chemically, thus reducing the productivity. The physical effects of these ions are to lower the osmotic pressure in the plant structural cells, thus preventing water from reaching the branches and leaves. The chemical effects disrupt plant metabolism. The comparison of the river water quality in the study area with the National and International recommended guidelines for irrigation water quality represent in Table 1.

Conclusion

Among the all tested physical parameters; pH, temperature and BOD exceeds standard level. On the other hand, in chemical analysis it is found that COD, Nitrate, Amonia, Sulphate, Cloride and Calcium level are much higher that permissible amount. The overall test results reveal that the water of Jamuna River is suitable for irrigation. Government need to take proper steps to control the effluent discharge to the river. Jamuna is a big river and many cities are situated on the bank of Jamuna. In this industrial era in Bangladesh, the government should take strict measureto maintain of suitability of water in jamuna river for surface irrigation.

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