

## Variation of Some Water Quality Parameters from Winter to Summer Period in Chittagong Karnafully River of Bangladesh

MILTON HALDER<sup>1\*</sup>, PRABHANGSHU KUMER DAS<sup>2</sup>, ABU SYED MOHAMMED MUJIB<sup>3</sup>, AMIT KUMAR DEY<sup>1</sup> and MD. HUMAYUN KOBIR<sup>4</sup>

<sup>1</sup>BCSIR laboratories Rajshahi, Binodpur Bazar-6206, Rajshahi, Bangladesh

<sup>2</sup>BCSIR laboratories Chittagong, Chittagong Cantonment-4220, Bangladesh

<sup>3</sup>Cox's Bazar Government College, Cox's Bazar, Bangladesh

<sup>4</sup>Soil Science Discipline, Khulna University, Khulna-9208

Corresponding Author Email: soilmilton06@gmail.com

<http://dx.doi.org/10.12944/CWE.12.1.04>

(Received: March 01, 2017; Accepted: April 10, 2017)

### ABSTRACT

A study has been conducted to investigate the variation of water quality parameters during January to June of 2014 in Karnafully River of Chittagong, Bangladesh. Water samples were collected from January to June 2014 of each month in 5<sup>th</sup> day. Samples of water from three points of Karnafully River were collected and brought in laboratory for analysis and analyzed by using different standard prescribed methods. Total eight water quality parameters were measured like as pH, EC, TDS, Total Hardness, Fe, Cl<sup>-</sup>, As and Turbidity. All the water quality parameters were attenuated from January (winter) to June (summer) except pH. Another important fact was most of the parameter's values exceeded the permissible limit recommended by WHO. It is a concerning event for ecology and environment of this catchment area. Our findings will convey a sound message for the government body and policy maker to set up rules and regulation in order to keep ecological balance as well as save our environment and this research will be helpful for public awareness. An immediate attention from the concerning body is mandatory in order to protect the aquatic environment of Karnafully River as well as food chain contamination.

**Keywords:** Water quality, Parameters, Variation, Karnafully, Summer, Winter.

### INTRODUCTION

Bangladesh is predominantly an agricultural based country within the south Asian region. Chittagong is the second largest and commercial capital in respect of developing and expanding among the cities of Bangladesh. Due to expedition of these city industrial activities, population growth, Agricultural practices, other manufactures, industrial effluents and oil and gas are discharged in a river named Karnafully. Different estuary of river present in Bangladesh and among them Karnafully is the most important one of them. This estuary is the meeting

point in where salt water from sea and upstream fresh water is continuously mixing. Not only for the purpose of drinking but also for the household activities as well as livelihood people of this area mainly depend on Karnafully River. In most of the developing countries their industrial wastewater and contaminated effluents routinely discharge in either nearby river, drains or increase sewage sludge contamination level<sup>1</sup>. Like this a large of number of garments factories, different public and private fertilizer factories, many national and international chemical industries have been established after the independence of Bangladesh on both

side of Karnafully river. As a result wastewater and contaminated by product of these river bank industries are directly discharged into Karnafully River through Mazirghat, Chaktai, Noakhal, Sundari, Gupta, Shikalbhaha, Ferighat and Mohesh and result pollutant load in this important river is increasing day by day. But water is the most remarkable commodity and essential to all life, both animals and plants<sup>2</sup>. Man can go nearly two months without foods, but can live only three or four days without water<sup>3</sup>. Contaminants of factories either urban or agriculture sources is continuously entering the food chain and decreasing the water quality<sup>4</sup>. Many works on heavy metal concentration in water, soil, fish has been done but works on water quality parameters variability of Karnafully River is not perform yet. Keeping this in mind our present research work has been conducted to examine the variation of the water quality parameters during winter to summer season of Karnafully River.

## MATERIALS AND METHODS

### Sampling Area

Three sampling area in Karnafully River were selected as Shah Amanat Bridge (22°19'34.4"N 91°51'12.0"E), Firingi Bazaar (22°19'32.9"N 91°50'13.2"E) and Sadar Ghat (22°23'46.1"N 91°53'19.1"E). Map of sampling area of Karnafully River are shown fig. 1

### Sample collection

Water samples from three selected points of Karnafully River were collected. Samples were

collected in month of January 05, 2014 to June 05, 2014. Total three samples from three points of 5<sup>th</sup> day of every (January to June) month were collected and in that way total eighteen water samples in six month were collected. The samples were tightly capped without any air gap. Then water samples brought to laboratory and analyzed by different prescribed method.

### Sample analysis

Total eight water parameters were determined for analysis of water parameters variation. Parameters were pH, EC, Cl<sup>-</sup>, As, Fe, Total Hardness, and Turbidity. Arsenic and Iron were determined by Atomic Absorption Spectrophotometer (AAS) and pH, EC, Cl<sup>-</sup>, Total Hardness, Turbidity were determined by prescribed method of Huq and Didar<sup>5</sup>.

### Statistical analyses

For the data analysis Microsoft Excel 2007 and SPSS 16.0 has been used.

## RESULT AND DISCUSSION

### Variations of pH, Conductivity (mS/cm), Fe (mg/L), As (mg/L)

pH of collected water samples varied from  $6.86 \pm 0.007$  to  $7.20 \pm 0.12$  from January to June (Figure 2[A]). With time the pH of Karnafully River increased from January to June that might be due to the receipt industrial discharge in which present more bicarbonates as well as carbonates and attenuating the discharge from sweater factory.

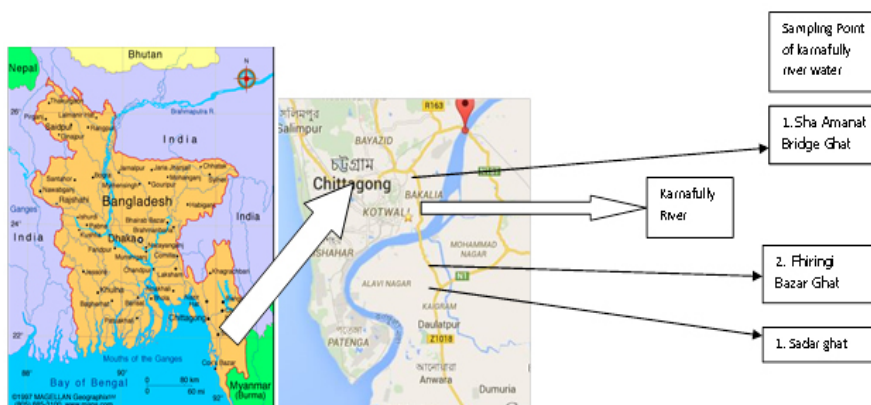


Fig. 1: Sample collections area in Karnafully River of Chittagong city in Bangladesh.

The results showed that water was slightly acidic to slightly basic and which is very beneficial for fresh water fauna and flora. Variation of pH values during winter to summer season were attributed to factors like as consumption of CO<sub>2</sub> by photosynthesis, OM

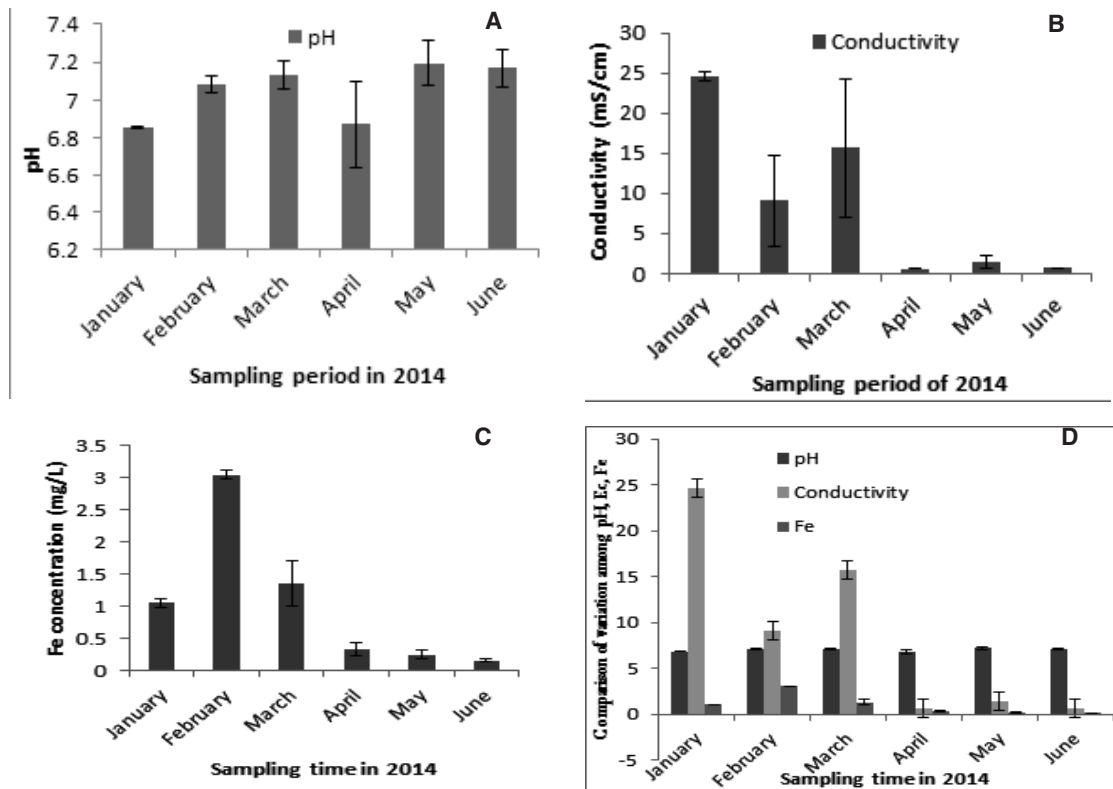
degradation, dilution effects of waste water with fresh water, temperature and salinity attenuation<sup>6</sup>. In Chittagong city has large number of garments factory mainly sweater factory but in winter season its production increased five times more than other

**Table 1: Pearson correlations co-efficient among the water quality parameters of Karnafully River**

	pH	Conductivity	Fe	Turbidity	Chloride	TDS	Hardness
pH	1						
Conductivity		1					
Fe			1				
Turbidity				1			
Chloride					1		
TDS						1	
Hardness							1

\*Correlation is significant at the 0.05 level

\*\*Correlation is significant at the 0.01 level



**Fig. 2: Fluctuation of pH (A), EC(B), Fe(C) and comparison among these parameters (D) during January to June 2014 of Karnafully River. Errors bars indicate the standard deviation of mean value. (n=3)**

season and at that time the basic chemical used are mostly acid types as a result the effluents are acidic that might be the reason for decreasing of water pH in winter. The pH values for all collected water samples were within the standard pH values recommended by WHO<sup>7</sup> and the pH ranges from

6.5 - 8.5. Electric conductivity of the Karnafully River water samples were differed from  $0.6 \pm 0.03$  mS to  $24.58 \pm 0.67$  mS (Figure 2[B]) from January to June respectively and the highest values was obtained in January that might be due to the increased the volume of industrial discharge in winter but volume

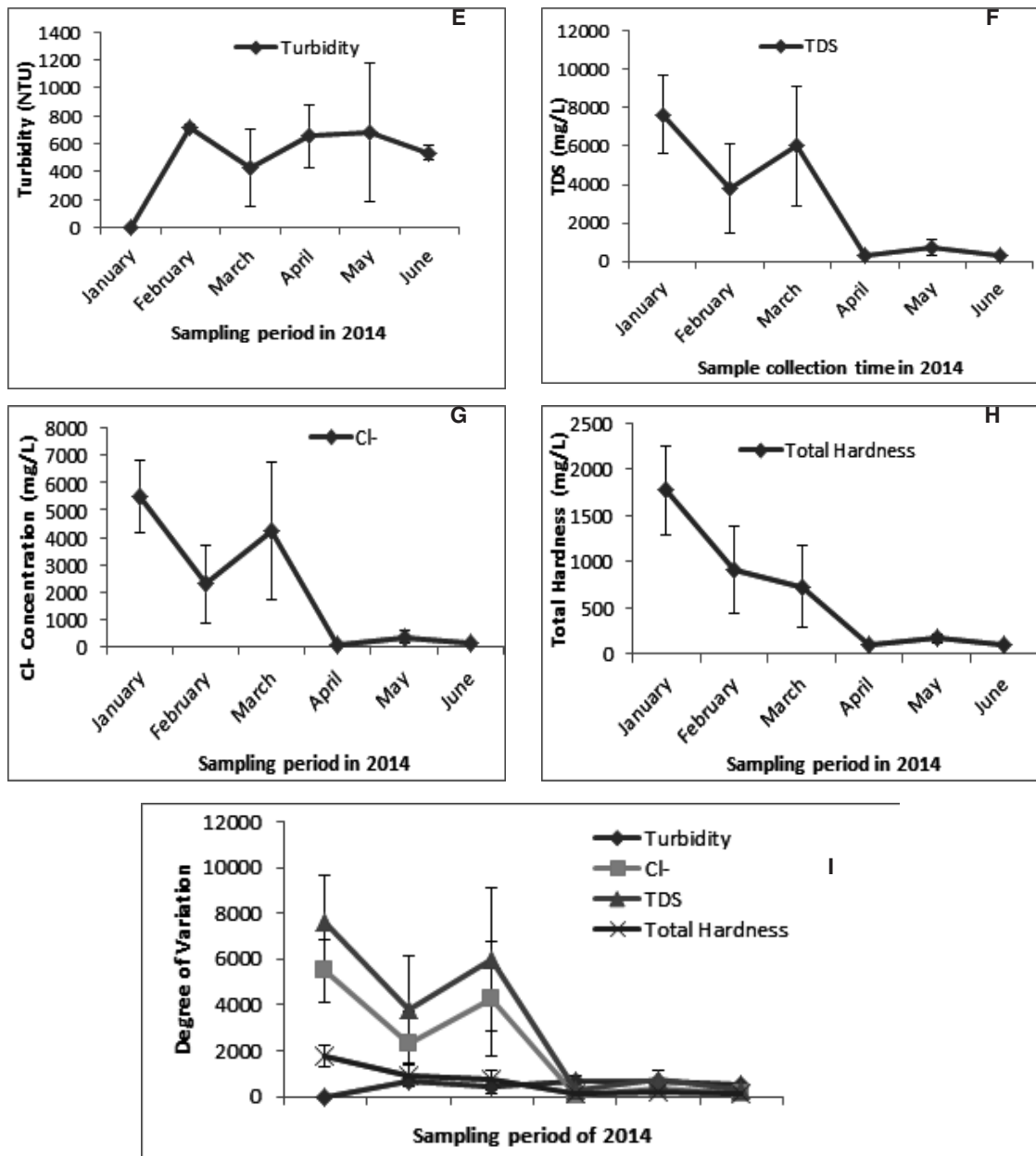


Fig. 3: Variation of Turbidity [E], TDS [F], Total Hardness [H], Cl- [G] concentration and comparison among these parameters [I] of Karnafully River of Chittagong, Bangladesh during January to June 2014. Errors bars indicate the standard deviation of mean value. (n=3)

of water transportation in river is decreased at that time. The result obtained for EC in this study exceeds the recommended limit of DoE (Department of Environment) standard of Bangladesh in most of the month from January to June 2014<sup>8</sup>. Conductivity of water in Karnafully was decreased significantly (Table 1). Iron range varied from  $3.05 \pm 0.07$  mg/L to  $0.16 \pm 0.02$  mg/L (Figure 2[C]). Among the above three parameters, pH did not make vigorous change but other two parameters attenuated during January to June (Figure 2[D]). Another parameter As concentration, which was nil throughout the all month. WHO<sup>7</sup> recommended limit for arsenic is 10mg/L and it's safe for drinking purpose. Ground water of Bangladesh is very arsenic contaminated<sup>9</sup> so river water should be the alternative source of drinking water and agricultural use for the people of Chittagong after purification.

#### **Variations of Turbidity (NTU), Total Hardness (mg/L), Cl<sup>-</sup> (mg/L), TDS (mg/L)**

The Turbidity of Karnafully River water was increased from January to June and ranged from  $2.56 \pm 0.28$  NTU to  $711 \pm 24.04$  NTU from January to June, 2014 (Figure 3[E]). In case of inland surface water, for Bangladesh Standard, TDS is 1000 mg/L. TDS of Karnafully river water samples was found to decrease in order throughout the month from January to June of 2014 (Figure 3[F]) which ranged from  $7630 \pm 2036.5$  to  $270 \pm 70.71$  mg/L. Higher values of TDS might be due to not only waste particles but also the presence of silt, clay in the river water from different sources. TDS values of Karnafully River water samples exceed the standard limit for inland surface water and the result was significant (Table 1). Hardness (Figure 3[H]) was measured highest in January ( $1781.2 \pm 482.53$  mg/L) and lowest in June ( $102 \pm 5.66$  mg/L), Kaur and Sharma<sup>10</sup> reported maximum hardness in summer which contradicted with our findings that might be due to least flow of water in Karnafully in compare to summer but

discharge from industry was higher than that of other season. Total Hardness of water samples from January to March exceeds the permissible limit (300mg/L) by WHO<sup>7</sup>. Rajagopal<sup>11</sup> suggested that decreasing water volume in river, presence of detergent and chloride, improving load of organic substances and other pollutant might be reason of improving hardness level. Concentration of Cl<sup>-</sup> in water indicates animal origin organic substances<sup>12</sup>. Chloride concentration was decreased from month as January to June and the value of chloride was significant. Highest chloride concentration was obtained in January ( $5485.89 \pm 1351.11$  mg/L) but least was observed in April ( $79.76 \pm 2.52$  mg/L). Chloride concentration increased in winter due to more discharge of garments and different industrial waste has been reported<sup>13</sup>. Only for month of January, March and May, Chloride concentration (Figure 3[G]) exceeds the permissible limit recommended by WHO<sup>7</sup> (250 mg/L). In figure 3[I] showed that comparative fluctuation of different water quality parameters from month of January to June in 2014.

#### **CONCLUSION**

All the parameters except pH were decreased throughout the month from January to June in 2014. In winter low turbulence and velocity in Karnafully River and carry low volume of water compare to other season but no change of discharge from industry of Chittagong city which might be the possible reason of fluctuation of the water quality parameters.

#### **ACKNOWLEDGEMENT**

We are grateful to BCSIR Laboratories Chittagong for the logistic support to conduct our current research work.

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