Assessment of Water Characteristics for Safe Usage: A Case Study at Different Points of Shitalakhya River

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Abstract

Due to rapid increase in population and high depletion rate of ground water table in Dhaka city, pressure is generating on surface water sources like rivers and canals which are being gravely polluted by human activities, poor drainage system, industrial and household wastes. Water quality testing for consumption purpose has been carried out on 5 different locations along the river Shitalakhya which is one of the prominent rivers in Bangladesh. The water samples were analyzed in the laboratory facility for 11 different parameters (pH, Color, Turbidity, Hardness, Alkalinity, Chloride, Arsenic, Total Coliform, Fecal Coliform, Total viable bacteria). The river water is found turbid as well as slightly acidic. Results shows high amount of total and fecal coliform presence indicating the potential contamination of the water source. Laws should be enforced strictly to prevent abuse of water ways. Regular monitoring and awareness is necessary to save the river.

Keywords: *Fecal Coliform, Shitalakhya River, Total Coliform, Turbidity, Water Quality.*

1 Introduction

Dhaka city is surrounded by some very important rivers and canals which play a vital role for its economic growth and in maintaining communication outside the city. Among those rivers Shitalakhya is a significant one. The Shitalakhya River is a distributary of the river Brahmaputra which is located in Narayanganj, an industrial zone of the country. There are a number of industrial units on its banks including the Adamjee jute mills. Thermal power houses are located along the river at Palash and Shiddhirganj. Industrial affluent dumped into the river resulting in high levels of pollution is a major cause for concern. Almost all the industrial units, large or small, discharge liquid effluents to water bodies which generally flow into the rivers and ultimately cause pollution of riverine environment (Islam, 2011).

A World Bank study indicated that four major rivers near Dhaka: Buriganga, Shitalakhya, Turag, Balu receive 1.5 million cubic meters of waste water every day from 7000 industrial units in surrounding areas and another 0.5 million cubic meters from other sources. Indiscriminate dumping of industrial and sewage wastes and increased encroachments are damaging the riverine environment of Bangladesh (Islam, 2011). The river Shitalakhya receives partially treated or untreated sewage effluent, untreated industrial effluent, surface runoff from nearby residence and industrial areas. The river is further polluted by household, clinical, pathological and commercial wastes and discharge of human excreta. In reality the river has become a dumping ground of all kinds of solid, liquid and chemical waste of bank side population. This study provides an assessment of the present status of water quality of the Shitalakhya River based on analysis of water sample collected and tested from the river.

The specific objectives of the study are:

- Assessment of surrounding environment at different locations along Shitalakhya River and identification of major sources of pollution.
- Collection and analyzing water samples from the River.
- Comparing the results with the Bangladeshi and International (WHO) standards (Alam J. B et al. ,2007)
- To provide some suggestions to improve the existing condition.

1.1 Present Situation

The Shitalakhya River is of significant importance to Narayanganj city in respect of water resources aspects and the ecological balance of the area. There are six major wastewater drains or khals falling into the Lakhya River which are Majheepara Khal, Killarpul Khal, Kalibazar Khal, Tanbazar Khal, B. K. Road Khal and DND Khal. The first five drains or khals convey wastewater from the Narayanganj City. Since there is no sewage treatment plant in Narayanganj, all wastewater generating from domestic and industrial sources are drained untreated through these drains/khals into the river. Besides those six major drains, there are more discharge points which carry wastewater from industries as well as households. The Balu River discharges pollution loads of domestic waste water (human waste and food waste) and industrial waste water (tannery and food processing industries) into Shitalakhya River. This poses a major threat to the Saidabad water treatment plant, whose intake structure is located downstream of confluence of Shitalakhya and Balu river. Evidently the quality of the water drawn through the intake structure would affect the efficiency of treatment at the plant and the quality of treated water. Saidabad wastewater treatment plant (SWTP) faces a major problem during the winter because of deteriorating water quality. Discharge in the Shitalakhya Rivers is greatly reduced but yet sewage and industrial wastes continue to enter the river system at the same rate as other times of the year.

2 Methodology

To determine the water quality of the river Shitalakhya, samples are needed to be collected from different places and should be taken few in numbers. Study area was chosen carefully considering its enormous importance to the residents of Narayanganj city. We chose five significant locations upstream and downstream of Saydabad Wastewater Treatment Plant (SWTP) to evaluate the water quality which are Point A (Narayanganj 5 no ghat), Point B (Narayanganj launch ghat), Point C (sand point), Point D (SWTP intake) Point E (1 km distance from SWTP intake point). Data was collected during two field trips in July, 2015.

3 Data Collection and Analysis

This study involves determination of physical, biological and chemical parameters of surface water at different points (Alam et.al , 2006). The most commonly used parameters are tested to ensure the quality of supply water are: pH, Color, Turbidity, Hardness, Chloride, Alkalinity, Iron, Arsenic, Total Viable Bacteria, Total and fecal coliform. All these parameters have certain environmental impacts and some of them can be hazardous to human and animal health if their presence in water is beyond the tolerable limits. The environmental conservation rule 1997 (ECR) standards for safe drinking water is followed here as a standard scale.

4 Result And Discussion

The pH range for the water samples ranges from 6.4 to 6.6 showed in Figure 1 which meets ECR 1997 standard and WHO standard for potable water. P^H value is found high in Point C. According to the ECR 1997 and WHO standard, the limit of fresh water color parameter should not be greater than 15 Pt-Co. But the result shows that the color parameter is extremely high in water samples which is in between 163-320 Pt-Co showed in Figure 2. Almost all the points show greater values.

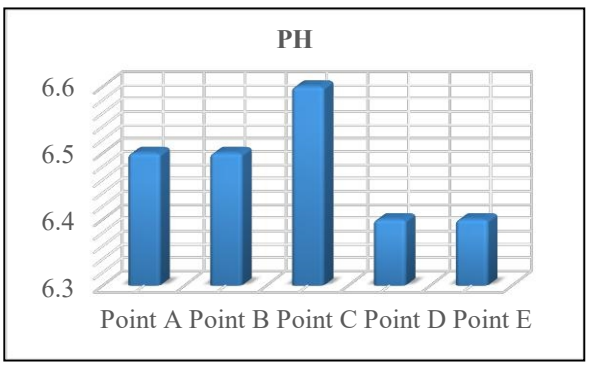

Figure 1. pH values of samples collected from different locations

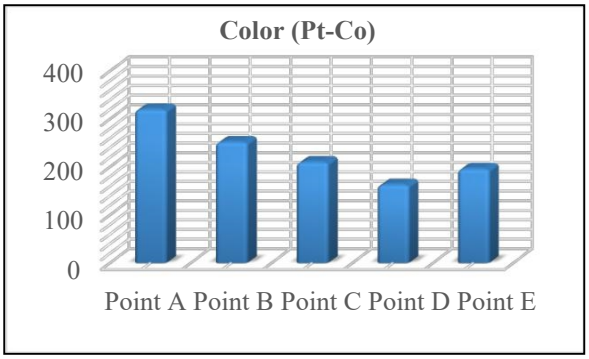

Figure 2. Color values of samples collected from different locations.

ECR 1997 recommends that the standard value of turbidity is 10 NTU and for WHO standard it is 5 NTU. Our experimented value is pretty high 28 to 62 NTU showed in Figure 3. The ECR 97 recommends a range of hardness for drinking water will be the range in 200 to 500 mg/l as CaCO3. The value we found was very less. No samples are found to have reached even the lower limit (Figure 4). According to the test result, the hardness limit is 0.3 to 1 mg/l set by ECR 97 for drinking water and WHO guidelines. The value is above the range that is 0.88 to 1.37.

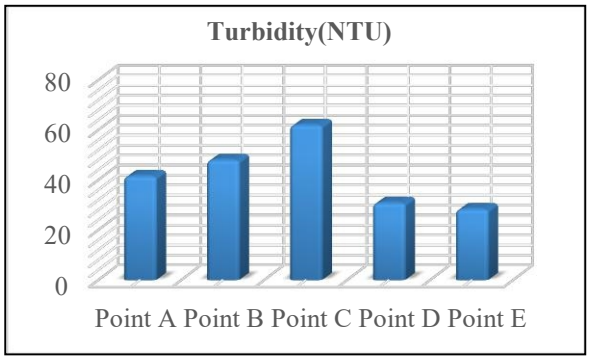

Figure 3. Turbidity values of samples collected from different locations

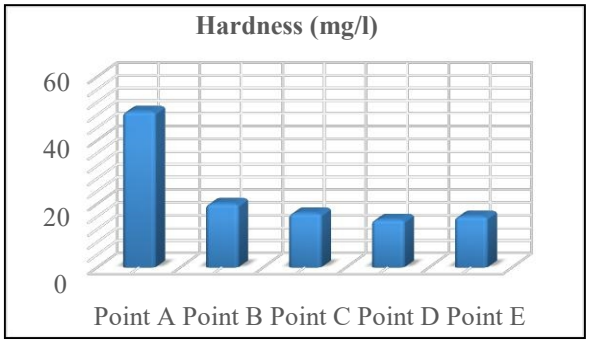

Figure 4. Hardness values of samples collected from different locations.

From the lab test, we observe high Alkalinity at Point A and Point B (Figure 5). There is no limit set for alkalinity by ECR 97 or WHO. The range of chloride is 150 to 600 mg/l in drinking water. The chloride value is below that limit that is between 17 to 35 mg/l showed in Figure 6.

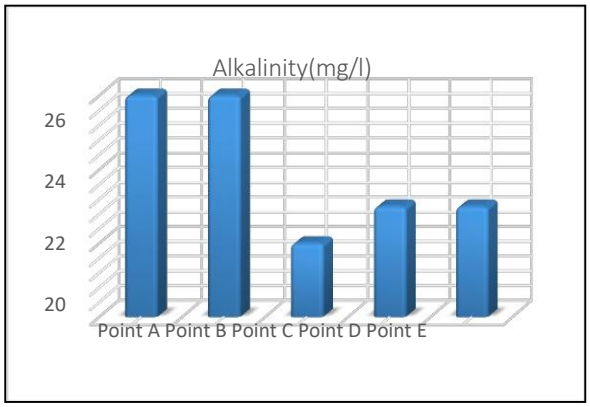

Figure 5. Alkalinity values of samples collected from different locations

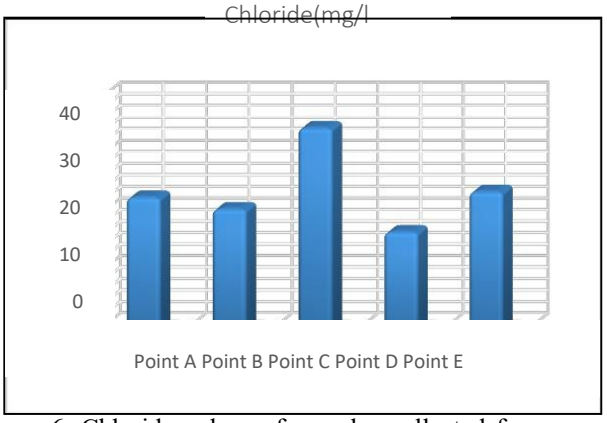

Figure 6. Chloride values of samples collected from different locations.

The limit of Iron is 0.3 to 1 mg/l set by ECR 97 for drinking water and WHO guidelines. The value is above the range that is 0.88 to 1.37 (Figure 7).

Bacteria and Coliform

Coliform organisms are indicators of water pollution. They are usually high in numbers in polluted water. Total coliforms are used as a general indicator of potential contamination with pathogenic organisms. Fecal coliforms, on the other hand, are more specific organisms because they refer to the coliforms that live in the intestinal track of humans and many other animals. According to Standards of ECR 1997 and WHO, TC and FC should be zero. But test results exceeded the standard value (Figure 8).

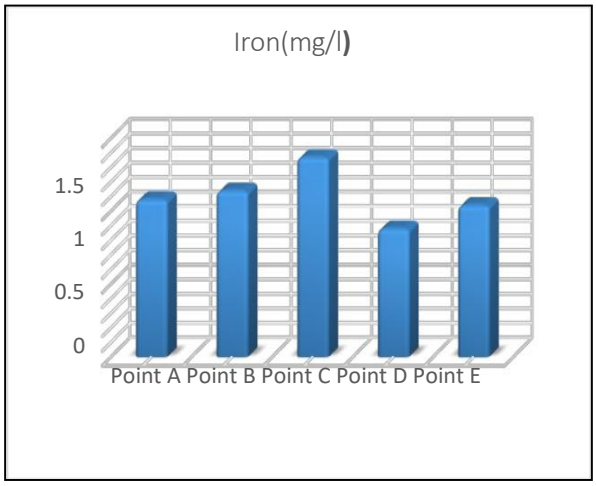

Figure 7. Iron values of samples collected from different locations.

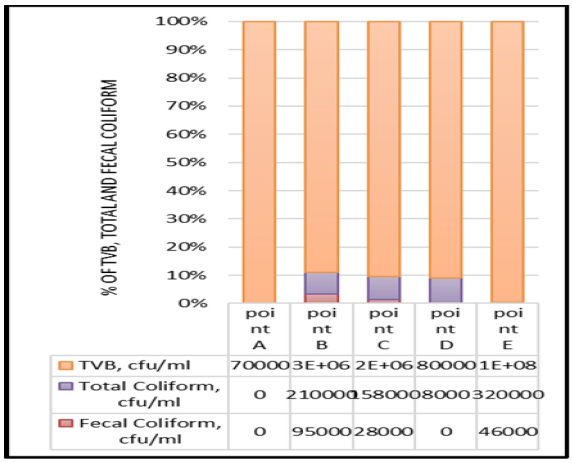

Figure 8. % of TVB, Total and Fecal coliform organism present in the sample water.

Arsenic: Arsenic is a chemical component which is injurious to health. The presence of Arsenic in the water of the river was found nil.

5 Conclusion

The polluted water hampers the aesthetic view of the river. Moreover, it destroys aquatic ecosystem. Industrial effluents contaminate the river water in such a way that people get affected with a number of diseases like diarrhea, gastric ulcers, respiratory illness, hepatitis and anemia by using such water for bathing and other domestic purpose (Islam, 2011). From the testing and result analysis the following results are found:

- In this study pH values falls within the limit of ECR 1997 standard. The pH concentration is below 7 which indicates slightly acidic nature.
- Hardness and chloride values are not that significant and poses no harm.
- Color values exceed the Bangladesh Standards as well as WHO guideline. Nowadays the river water looks like black gel due to huge discharge of industrial and household waste.
- Turbidity values exceeded Bangladesh Standards.
- There is no standard value for Alkalinity. But we have found that our selected locations represent some Alkalinity in water.
- According to Standards of ECR 1997 and WHO, TC and FC should be zero. But test results exceeded the standard value. Total coliforms should be absent immediately after disinfection, and the presence of these organisms indicates inadequate treatment (WHO).

6 Limitations of the study

- For time limitations only five locations were selected for sample collection on the basis of extreme pollution.
- Seasonal variations were not taken into account. It was not possible due to time and resource constraints.
- Heavy metal concentration can seriously affect human health. Hence it could be measured in future study.

7 Recommendations

- Proper dredging of the existing river and removing non degradable matters from the river bed.
- Removing unauthorized establishment from the river bank and maintaining a regular monitoring system against the land grabbers.
- Strong rules and regulations should be introduced so that industrial effluent cannot be thrown directly into rivers.

- Wastewater treatment plant is needed for each and every industrial unit to reduce the pollutant load on the river.
- Laws should be enforced strictly to prevent abuse of water ways and to save the river Shitalakhya.
- Public awareness is vital to save the river from being polluted.
- Use of river water for bathing, washing on the river bank should be made limited to the people living nearby.

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