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An Investigation into Chemical Parameters of Water of Dhaleswari - A River alongside Tannery Village of Bangladesh

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Abstract: This investigation attempts to assess the chemical parameter of water of Dhaleshwari river Savar, Dhaka alongside the newly constructed tannery village of Bangladesh. The chemical parameters like pH, Electrical Conductivity (EC), Dissolve Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Salinity are determined. The result reveals that the pH of water collected at different points and at different times of year were ranges from 7.60 to 6.50. EC of water collected at different points and at different times of year were ranges from11.80 µS/cm to 2080 µS/cm. The average value of DO at spot-1 was 4.79166±3.23 mg/l. Spot-2 showed average DO about 6.571667±1.47 mg/l. Biological Oxygen Demand (BOD) of water collected at different points and at different times of year ranges from 1.13 to 17.1 mg/l. Throughout the study period the monthly value of COD were within the range of 218.12mg/L (as minimum value) to 1276.6 mg/L (maximum value). In the study area Salinity of water collected at different points and at different times of year ranged from 0 (minimum) to 0.1 (maximum).

Keywords: Water Quality, Chemical Parameter, COD, BOD, Electrical Conductivity, Dhaleshwari River, Tannery Village

1. Introduction

Bangladesh is a riverine country. The rivers are the lifeline of this country. It's economic growth and developments are highly influenced by river water and in terms of quality, the river water of the country is unprotected from untreated industrial effluents and municipal waste water, runoff pollution from chemical fertilizers and pesticides and oil lube spillage in the coastal area from the operation of sea and river ports [1]–[4]. Rivers also provide fish, an important source of protein. Flooding of the rivers during the monsoon season causes enormous hardship and hinders development, but fresh deposits of rich silt replenish the fertile but overworked soil [5]. The rivers also drain excess monsoon rainfall into the Bay of Bengal. Thus, the great river system is at the same time the country's principal resource and its greatest hazard.

Like many other counties of the world, river pollution in Bangladesh is a burning issue. Abundant research has carried out and many recommendations have been forwarded to protect the rivers from pollution [6]–[9]. Water pollution is exceeding the limit in most of the water sources, and has become a great threat to the survival of aquatic species. The rivers of Bangladesh are the worse victim of pollution, especially the rivers which stands in the neighborhood of the Dhaka city is being polluted tremendously.

Savar is one of the largest industrial zones near Dhaka in Bangladesh. Dhaka Export Processing Zone (DEPZ) is an industrial area located at Savar in which about 86 industries already exist. These industries generate a large amount of effluent every day and discharge into the adjacent irrigation channels and wetlands which finally pass into the adjacent river [10]–[12]. The process of relocating tanneries from the city's Hazaribagh area to the tannery village, Horindhora, Savar adjacent to Dhaleswari river has been completed in the year 2017. Establishment of infrastructure at the 200 acre tannery estate has been completed. About 72 factories have already started working at the Savar tannery estate, the rest of the factories are under construction and they will be able to start their factories within a short time. In this tannery estate a central effluent treatment plant (ETP) has been set up but it is not fully functional from the very beginning [13], [14]. With such a major effluent

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treatment plant not working properly, the nearly Dhaleswari river is feared to become vulnerable to pollution. Earlier, non-treated and toxic waste materials released from Hazaribagh tanneries into the nearby canals, finally flowing into the Buriganga river, played havoc with a densely populated, sprawling area. A recurrence of the practice is set to spawn a terrible nightmare for the rural neighbourhood adjacent to the Savar Estate. In April 2017, the government shut 220 tannery industrial units at Hazaribagh and forced them to relocate to Savar. The number of the tanneries of Hazaribagh was about 220 and they discharged some 21,600 cubic meters of liquid waste and 88 tons of solid waste per day, posing a serious threat to the livelihood of some 1,00,000 people and prompting observer us it to be on the brink of environmental digesters. So it doesn't take much more effort to imagine that what would be future of the Horindhora and the river Dhaleswari.

Untreated wastes are thrown into the river as most of the industries have no Effluent Treatment Plant. According to an industrial survey conducted by Bangladesh Center for Advanced Studies (BCAS) in 2009, only about 40% industries have ETPs. In 10% industries, ETPs are under construction and about 50% industries have no ETP establishment. That is, more than 50% of waste generated by the industries eventually goes to the rivers untreated. While the leather sector brought home hundreds of millions dollars in export earning over the decade, its pollution took its toll on the fish resource, the economic value of which had never been calculated.

People living near the rivers, having no alternative, are forced to use polluted river water. Some also use the water because they are unaware of health risks. This causes spread of water borne and skin diseases. Solid waste and different effluents dumped into the rivers make it difficult for fishes and other sub-aquatic organism to live. When solid waste and effluents run into the river, the Biological Oxygen Demand (BOD) in the water rises, creating oxygen crisis for the sub aqueous life. As the Dissolved Oxygen (DO) content of the river water is decreased below the critical level of four milligram per liter it is posing threats to bio-diversity in and around the rivers. Moreover, due to river encroachment and dumping of solid waste into the rivers the rivers are losing their natural flow.

In this study an attempt was made to assess the water quality of Dhaleswari river with some physico-chemical parameters at two points namely; Nayarhat (upstreams of the river) & Horindhora at Hemayetpur (Downstreams of the river). The work would be the reference work when the river would be severely polluted after fully launching the newly constructed tanneries in the tannery village. Moreover, now the status of physic-chemical status of water of the Dhaleswari river is scanty or very few. So, considering all sorts of things the present study was carried out to assess the water quality of the Dhaleswari river with the following aim and objectives:

The main objectives of this study are given below:

1. To determine the concentration of chemical parameters in surface water in order to determine the extent of pollution level at two points (upstream & downstream) of Dhaleswari river.
2. To assess the monthly variation of those parameters.
3. To predict a possible upcoming condition of the river water in near future due to increasing pollution.

2. Sample collection

During this study, water sample were collected from Dhaleshwari river to assess the chemical parameters like pH, Electrical Conductivity (EC), Dissolve Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD),and Salinity. Samples were collected monthly from the main stream of the river at its upstream (spot-1) and downstream (spot-2) from July 2013 to June 2014 in plastic bottles of 500ml. During sampling they were rinsed with fresh water three times then filled to the brim at a depth of 2ft below the surface water from the designated sampling points. Then the samples were labeled and transported to the laboratory, stored in the refrigerator for analysis.

3. Chemical factors

The total number six chemical factors were measured during this investigation. The recorded data on these chemical factors are briefly presented below.

3.1. Hidrogen Ion Concentration (pH)

In the study area pH of water collected at different points and at different times of year ranged from 6.50 (minimum) to 8.81 (maximum). The pH of water was slightly high from November to April but the highest pH value found during the month of March (pH = 7.60) at Spot-1.

The pH of water was slightly low during wet season from June to October and the lowest pH value found during the month of June (pH = 6.50) at Spot-2 (See Figure 1)

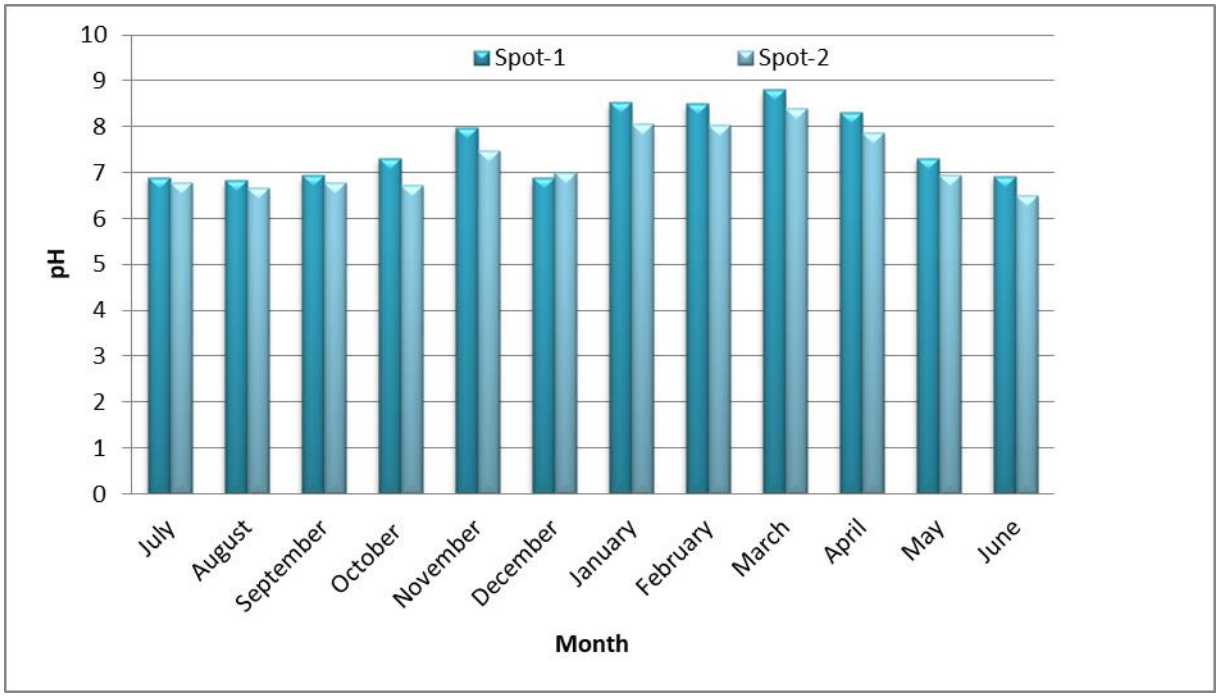

Figure 1. Monthly variation in pH of Dhaleshwari river at two different spots

3.2 Electrical Conductivity (EC)

EC of water collected at different points and at different times of year were ranges from 11.80 µS/cm to 2080µS/cm.

The EC value of water was comparatively high in February and March and the highest EC value of water recorded during the month of March (EC = 2080µS/cm) then the value suddenly falls at a remarkable level.

The EC value of water were tend to low from May to October and the lowest EC found in April (EC = 11.80µS/cm) at Spot-2. (Figure 2)

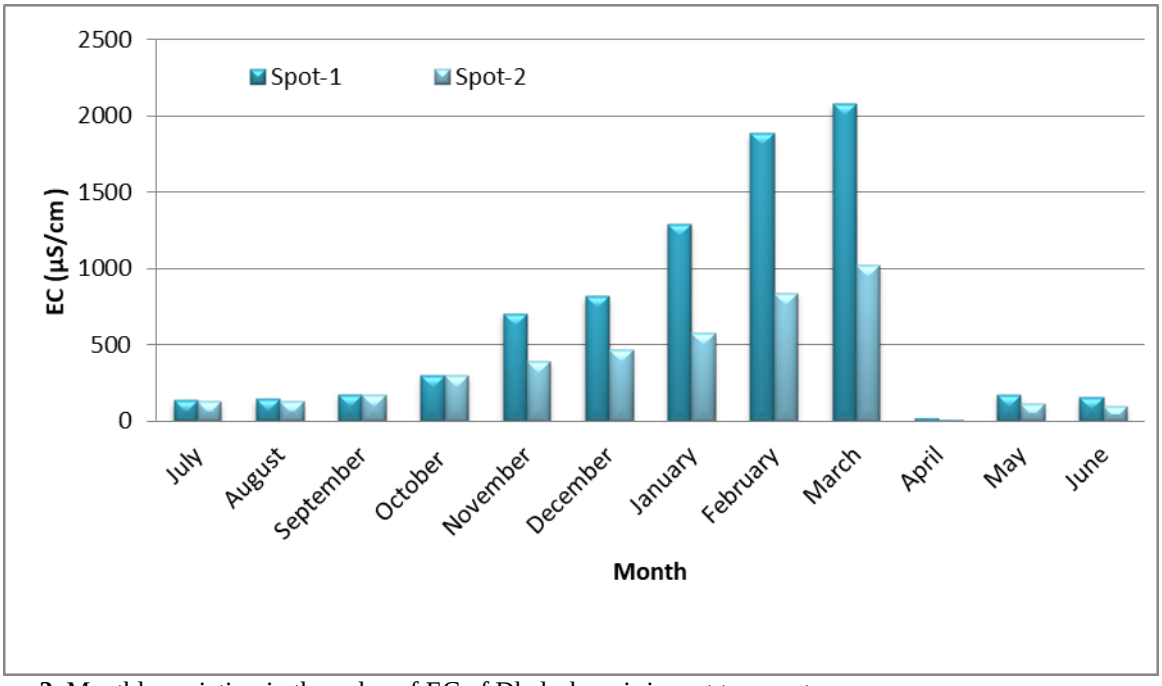

Figure 2. Monthly variation in the value of EC of Dhaleshwari river at two spots.

3.3. Dissolve Oxygen (DO)

DO concentration of water collected samples throughout the year at upstream and downstream of Dhaleshwar river ranged from 0.2 to 9.42 mg/l . The DO of water was comparatively high during wet season from March to October The average value of DO throughout the year was 5.430833 mg/l and the highest value DO of water examined during the

month of March (DO = 9.42 mg/l) .
On the other hand, DO of water was considerably low during dry season from November to February and the value of DO found during the month of February (DO = 0.2 mg/l). In case of sampling points, at Spot-1 the highest value was 8.06mg/l found in October and the lowest value was 0.2mg/l found in February. The average value of DO at spot-1 was 4.79166±3.23 mg/l. Spot-2 showed average DO about 6.571667±1.47 mg/l, the highest value (9.42mg/l) was found in March and the lowest (3.14mg/L) in February. The result is depicted in Figure 3.

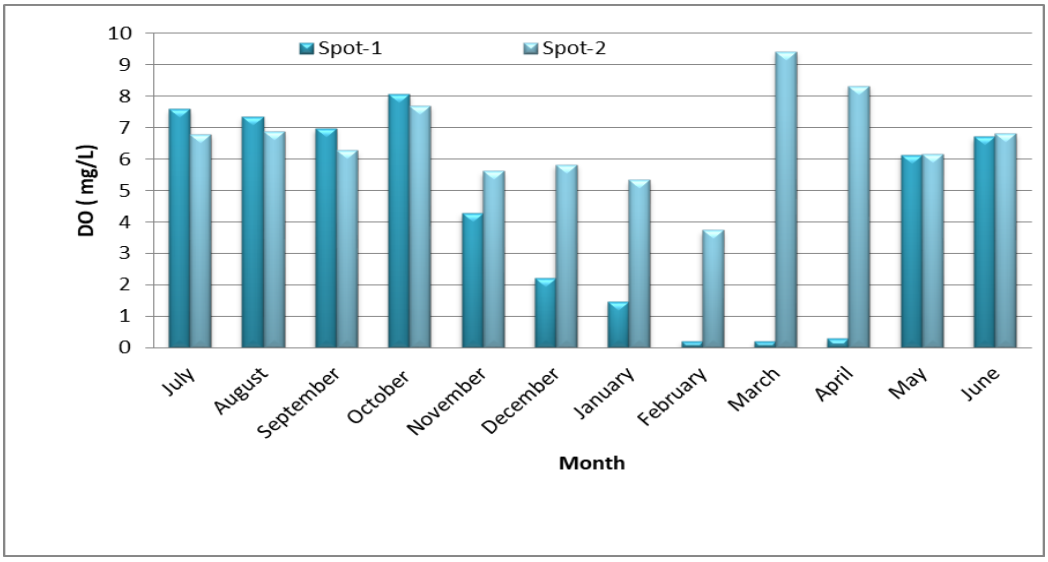

Figure 3. Monthly variation in the value of DO of Dhaleshwari river at two different spots.

3.4 Biological Oxygen Demand (BOD)
Biological Oxygen Demand (BOD) of water collected at different points and at different times of year ranged from 1.13 to 17.1 mg/l. The BOD of water was comparatively low during wet season from April to August. The lowest BOD of water examined during the month of August (BOD = 1.3 mg/l) (Figure 4). On the other hand, BOD of water was considerably high from October to February and the highest BOD of water found during the month of November (BOD = 17.1 mg/l). The result of the BOD is shown in Figure 4.

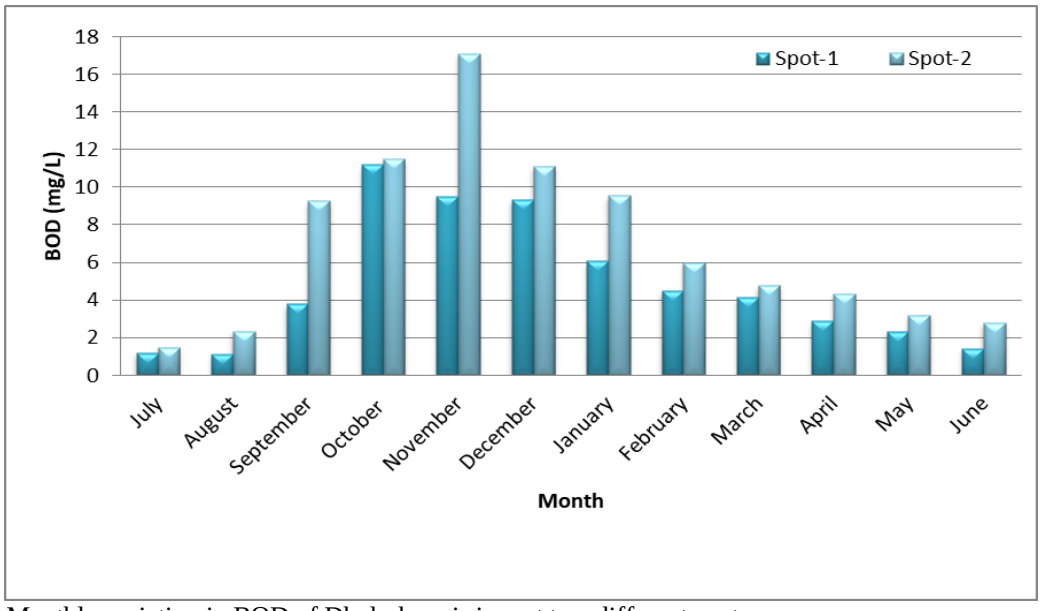

Figure 4. Monthly variation in BOD of Dhaleshwari river at two different spots

3.5 Chemical oxygen demand (COD)

Throughout the study period the monthly value of COD were within the range of 218.12mg/l (as minimum value) to 1276.6 mg/l (maximum value).

The highest value was recorded in December at spot-1 and the lowest value from spot-2 in July. The fluctuation of values started from March then continues up to August then the values started to increase from September up to February and highest in December. The full result of COD value is depicted in Figure 5.

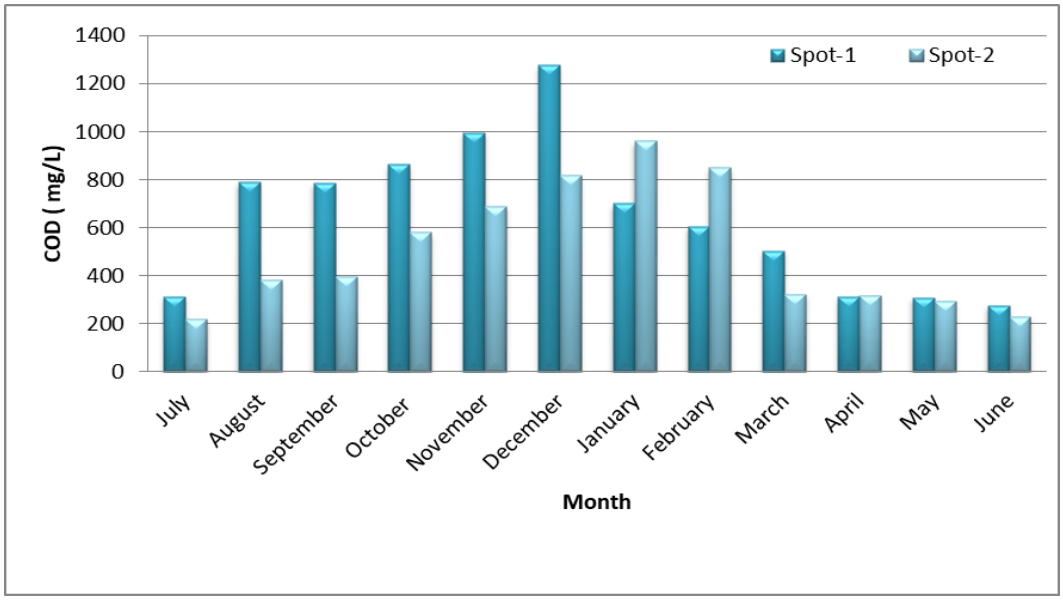

Figure 5. Monthly variation in COD of Dhaleshwari river at two different spots

3.6 Salinity

In the study area Salinity of water collected at different points and at different times of year ranged from 0 (minimum) to 0.1 (maximum).

The Salinity of water was slightly high from December to April but the highest value found during the month of March (0.1%) at Spot-1. Salinity of water was slightly low during wet season from June to August and in those months salinity was 0 (Figure 6).

The average value of salt concentration at spot-1 was 0.044±0.001% and at spot-2 concentration was 0.018±0.002%.

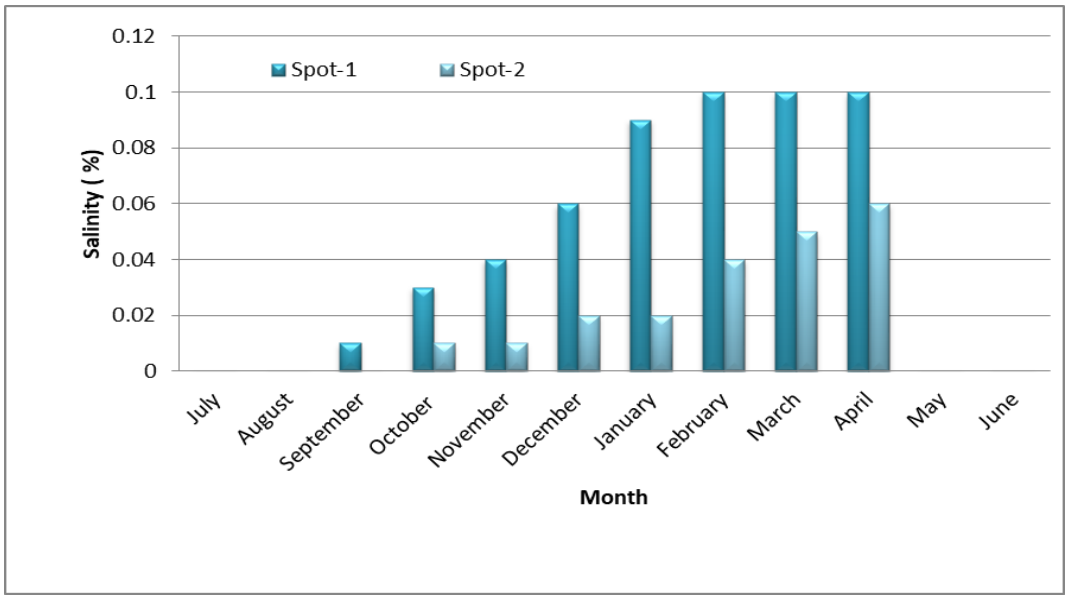

Figure 6. Monthly variation in Salinity of Dhaleshwari river at two different spots

4. Conclusion

Water quality is an important issue for biotic species and/ or to any human need or purpose. It is imperative to assess the quality of water for the aquatic life. The most common standards used to assess water quality related to health of ecosystems, safety of human contact, and drinking water. In this study, therefore chemical parameters like pH, Electrical Conductivity (EC), Dissolve Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Salinity are determined. The result shows that the pH of water collected at different points and at different times of year were ranges from 7.60 to 6.50. EC of water collected at different points and at different times of year were ranges from 11.80 µS/cm to 2080 µS/cm. The average value of DO at spot-1 was 4.79166±3.23 mg/l. Spot-2 showed average DO about 6.571667±1.47 mg/l. Biological Oxygen Demand (BOD) of water collected at different points and at different times of year ranged from 1.13 to 17.1 mg/l. Throughout the study period the monthly value of COD were within the range of 218.12mg/l (as minimum value) to 1276.6 mg/l (maximum value). In the study area Salinity of water collected at different points and at different times of year ranged from 0 (minimum) to 0.1 (maximum).

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