WATER QUALITY AND POLLUTION SOURCES OF GULSHAN LAKE

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ABSTRACT:

The study focuses on the monitoring of water quality of Gulshan Lake and identification of sources of pollution of the Lake through field observations and discuss with local people.

Gulshan Lake is the northernmost lake in a chain of water bodies (Gulshan Lake, Hatirjheel, Begunbari Khal, Balu River and Shitalakhya River) in Dhaka, suffering from highly significant pollution thus increasing pollution from north to south. Gulshan-Baridhara Lake was declared an Ecologically Critical Area (ECA) in 2001. It is very important to take immediate steps to restore the water quality of Gulshan Lake.

To monitor the Gulshan water quality, the samples were collected from four cross sections starting from September 2012 to March 2013 covering both dry season and wet season. Collected samples were analyzed in the Department of Civil Engineering Laboratory of University of Asia Pacific (UAP).

The various parameters of the water such as pH, Color, Total Dissolved Solids (TDS), Total Suspended Solid(TSS), Turbidity, Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) were examined for water of each sampling points to monitor the level of these parameters where it exceed or within the permissible limit of Bangladesh standard.

Monitoring results showed the fluctuations in chemical composition of Lake Water both spatially and temporally. It is observed that pH has slight seasonal variation throughout the study period with the values of 5.23 to 7.42. In dry season average pH value is 7.36 while in wet season value is 6.80. The pH of Gulshan lake water is high in dry season. The spatial variation shows the pH increase slightly from upstream (Near Madani avenue.) to downstream (Gulshan-Badda link road).

The Lake water has been characterized by very low DO (mostly below 5 mg/l) & the high BOD5 (up to 101.0 mg/l) indicated significant organic pollution. Among the other tested parameters - Color, TDS, Turbidity and TSS showed the most significant seasonal variation due to the influence of rain and storm runoff. It was observed that the concentration of Color and TDS increased in dry season and concentration of TSS and Turbidity increased during the wet season. During dry season the maximum value of TDS is 334 mg/l and wet season minimum TDS value is near 212 mg/l. It is observed from seasonal variation of TSS throughout the study period of the values 34 mg/l to 176 mg/l.

The study was done created awareness regarding the environmental issues in Gulshan Lake. Various attempts should be taken to restore the water qualities of the Gulshan Lake like - illegal encroachment and waste dumping should be removed and stopped through implementation of existing laws and regulations. Moreover public awareness is necessary. It is very important to develop a comprehensive management plan for revival of all lakes, khals and wetlands within Dhaka city.

Keywords: Organic Pollution, Wetland, Turbidity, Parameters of the Water, Seasonal Variation, Storm Runoff
1. INTRODUCTION

Today, people are concerned about the quality of the drinking water. Conservation of freshwater resources has now become an issue of global concern because this water is one of the vital resources for treatment as drinking water. Fortunately Bangladesh, because of its geographical location holds adequate reserves of freshwater. But due to excessive population pressure, unawareness and lack of enforcement of legal matters, very few of her water bodies retain good water quality and biodiversity. A number of investigations have been carried out in some lakes situated in and around Dhaka metropolis area to evaluate their water quality. In this report Gulshan Lake study is articulated.

2. THE STUDY

Gulshan Lake is the northernmost lake in a chain of water bodies (Gulshan Lake, Hatirjheel, Begunbari Khal, Balu River and Shitalakhya River) in Dhaka, suffering from highly significant pollution. Gulshan Lake with an area of about 100 ha and is located at 23°48’ N and 90°25’ E of Dhaka city. The length of the lake is 3.8 km which covers an area of 0.0160 km². It has an average depth of 2.5 m and a volume of 12 ×105 m³. The peripheral sides are, northern at Baridhara, southern at Tejgaon- Hatirjheel, western at Gulsan-Banani and eastern at Badda area. Gulshan Lake is one of the major of few remaining water bodies of Dhaka city; not only is its presence important for the sustenance of the eco-system, it is also considered as major main source of groundwater recharge at those area.

Gulshan Lake is the northernmost lake of the chain of water bodies in Dhaka (Gulshan Lake, Hatirjheel, Begunbari Khal, Balu River and Shitalakhya River) increasing pollution from north to south. Due to proper supervision of the regulatory and maintenance body, Gulshan-Baridhara Lake was declared an Ecologically Critical Area (ECA) in 2001. The water of the lake is polluted day by day and during the dry season the level goes down and the pollution becomes worst. Lack of proper maintenance of existing drainage system results indiscriminate drainage outlets which dispose untreated domestic and commercial wastewater and dumping of solid wastes and moreover encroachment has degraded the overall quality of the Lake. Sewage from the Badda, Baridhara, Gulshanand Banani residential areas along with toxic discharges from the nearby industries have contaminated the water of Gulshan Lake also.

The poor water quality of Gulshan Lake is also contributing to the pollution of Hatirjheel, where a restoration project is already implemented and the downstream water bodies. It is very important to take immediate steps to restore the water quality of Gulshan Lake. The study focuses on the monitoring of water quality of Gulshan Lake and identification of sources of pollution of the Lake through field observations and discussion with local people.

For monitoring the Gulshan water quality, the samples were collected from four cross sections as shown in the table-1 and figure-1. Starting from September 2012 to March 2013 covering both dry season and wet season. Surveys were also carried out for observing the types of outfalls discharging into Gulshan Lake from same location (table-1) during the same study period. The various parameters of the water such as pH, Color, Total Dissolved Solids (TDS), Total Suspended Solid(TSS), Turbidity, Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) were examined for water of each sampling points to monitor the level of these parameters where it exceed or within the permissible limit of Bangladesh standard.

| Sample | Sampling Location | GPS Coordinates | Area/
|---|---|---|---
| P1 | 23° 47’ 53” | 90° 25’ 7.54” | United Nations Road
| P2 | 23° 47’ 46.68” | 90° 25’ 5.22” | Baridhara Lake
| P3 | 23° 47’ 46.12” | 90° 25’ 9.24” | High Commission of Canada
| P4 | 23° 47’ 44.99” | 90° 25’ 6.92” | Gulshan Road No. 96
| P5 | 23° 46’ 51.83” | 90° 25’ 13.72” | Near Middle

Table 1: Location of the water sampling points of Gulshan Lake
During surveys it is observed that the major types of wastewater/ storm water outfalls contributing to the pollution of Gulshan Lake (study areas) include (i) Storm sewer pipes, (ii) Open channels and (iii) Small private outfalls. Some illegal connection was observed which is made from domestic and commercial establishment into storm sewer. These storm sewers are mostly made of concrete, plastic and metal pipes were also seen. Many household drains and industrial outfalls have been seen which is mainly open. Roadside drains are the most common open channel outfalls in those areas. Common examples of private outfalls include: roof drains; parking lot drainage; direct discharge of domestic/ industrial wastewater; outlet from small shops etc. were easily identifiable. Some outlets from some nurseries (near high commission of Nepal) were observed used for discharging water mixture with chemicals and dust into the lake. Some hanging toilets are made at the bank of the Lake and discharges human waste directly into the lake . Some unusable and hidden private outfalls were to be found. But the sources of some were not identified.

Table 1: Sample collected from the four points P1, P2, P3 & P4 respectively (both sides of Young bridge Gulshan-2) & from the four points P5, P6, P7 & P8 respectively (both sides of Gulshan-Badda link road, Gulshan-1)

<table>
<thead>
<tr>
<th>Point</th>
<th>Longitude 1</th>
<th>Latitude 1</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>P6</td>
<td>23° 46’ 51.27”</td>
<td>90° 25’ 8.16”</td>
<td>Gulshan Road No. 130</td>
</tr>
<tr>
<td>P7</td>
<td>23° 46’ 49.29”</td>
<td>90° 25’ 14.03”</td>
<td>Near Badda High School</td>
</tr>
<tr>
<td>P8</td>
<td>23° 46’ 48.03”</td>
<td>90° 25’ 8.3”</td>
<td>Near Regent Airways</td>
</tr>
</tbody>
</table>

Fig 1: Sample collected from the four points P1, P2, P3 & P4 respectively (both sides of Young bridge Gulshan-2) & from the four points P5, P6, P7 & P8 respectively (both sides of Gulshan-Badda link road, Gulshan-1)
Factors affecting the monitoring of water quality trends include the selection of sampling points, their geographic locations, sample collection schedules, sample collection methods, sample processing methods, analytical methods and the period of sample collection. So, the sample after collecting was kept in such a way that the concentration of the species is to be analyzed remains unchanged during transportation and possible storage. Collected samples were analyzed in the Department of Civil Engineering Laboratory of University of Asia Pacific (UAP).

Monitoring results showed the fluctuations in chemical composition of Lake Water both spatially and temporally. It is observed that pH shows slight seasonal variation throughout the study period with the values of 5.23 to 7.42. In dry season average pH value is 7.36 while in wet season value is 6.80. The pH of Gulshan lake water is high in dry season. Due to the dilution of alkaline substances into lake water by storm runoff in wet season pH value decreases. The spatial variation shows the pH increase slightly from upstream (Near Madani Avenue, Gulshan Avenue) to downstream (Gulshan-Badda link road).

The Lake water has been characterized by very low DO (mostly below 5 mg/l) & the high BOD₅ (up to 101.0 mg/l) indicated significant organic pollution. From the ECR (1997) of Bangladesh standards of DO for inland surface water bodies for different uses shows a minimum DO requirement is 5 mg/l for different purposes including pisciculture, which is also recommended by USEPA (1986) for coldwater fisheries. Many dead fishes have been found afloat in the Lake during the study. A trend of decreasing DO and increasing BOD with the advancement of dry season was observed; the situation improved during the wet season, but only marginally.

Among the other tested parameters - Color, TDS, Turbidity and TSS showed the most significant seasonal variation due to the influence of rain and storm runoff. It was observed that the concentration of Color and TDS increased in dry season and concentration of TSS and Turbidity increased during the wet season. During dry season the maximum value of TDS is 334 mg/l and wet season minimum TDS value is near 212 mg/l. TDS increase slightly from upstream (Near Madani Avenue, Gulshan Avenue) to downstream (Gulshan-Badda link road).

It is observed from seasonal variation of TSS throughout the study period of the values 34 mg/l to 176 mg/l. Generally turbidity shows relatively high concentrations of TSS for all the samples collected in wet season which may be due to input of suspended materials into lake with storm runoff. This trend is observed for most natural water bodies. TSS value relatively shows higher mode like 110 mg/l in wet season (only Sep, 2012), though in dry season the maximum value of TSS shows 176 mg/l, this is the only cause that the study covers only month of wet season. For the same reason the actual trend of turbidity variation cannot be ascertained during study period. It is observed Color varies seasonally throughout the study period with the values of 341Pt-co to 1077 Pt-co. During dry season maximum value of color is 1077 Pt-co and in wet season the minimum value is 341.5 Pt-co. The maximum permissible color for domestic supplies is 10 to 20 Pt-Co, thus Lake Water is unusable in this purpose. Waterways with dark-colored water or those with dark muddy bottoms, absorb heat more. Thus, Gulshan Lake water is likely to get warmer during dry season. Euthrophication is also observed very significant during dry season with the abundance growth of algae (green color) but in advancement of dry season it becomes less detectable.
3. CONCLUSION

Dhaka city has been growing without much of plan and the city lacks systematic waste management system as well. The study was done created awareness regarding the environmental issues in Gulshan Lake. Various attempts should be taken to restore the water qualities of the Gulshan Lake like - illegal encroachment and waste dumping should be stopped through implementation of existing laws and regulations. Illegal residential buildings have to remove from the bank of the Lake. Development of domestic sewer network in the Gulshan Lake watershed areas for diverting domestic sewage (and also industrial effluent, if any) flows away from the Lake is the most important and urgent task in this regard. Moreover public awareness is necessary. It is very important to develop a comprehensive management plan for revival of all lakes, khals and wetlands within Dhaka city.

4. REFERENCES


