A Study of Clean Water and Sanitation

(An initiative of Daffodil International University)

Title:

Water Quality Assessment of the Physico-Chemical Parameters of Dhaleshwari River, Dhaka, Bangladesh

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1. Introduction:

In 2015, the United Nations General Assembly established 17 Sustainable Development Goals (SDGs) also known as Global Goals to take the action to end poverty, to protect the planet, which will bring peace and prosperity for people and the planet within 2030. Sustainable Development Goal 6 in short SDG 6 includes "Clean water and sanitation for all", which will be achieved by at least 2030. Among the 6 specific targets of this goal improve water quality by reducing pollution, eliminating dumping, minimizing release of hazardous chemicals and materials, and ensure freshwater supplies are major concern for the environment and society. Along with these the adverse effects of climate change can decrease the quality of freshwater bodies, which ultimately effects on the overall ecosystems.

Freshwater ecosystem is the most vital ecosystem for the survival of Earth's Biosphere. In Bangladesh, Freshwater ecosystem is continuously degraded due to rapid industrialization, waste water dumping, agricultural run-off and above all the lack of knowledge. Most of the aquatic bodies, includes- rivers, lakes, ponds are being polluted continuously. As a riverine country Bangladesh is covered by several mighty rivers which enriched with freshwater ecosystems. Now a days, river water pollution and degradation become a major concern for the country due to rapid industrialization along the riverside without proper planning and environmental consideration [1].

In Bangladesh the leather processing industry/the tannery industry has been grown rapidly and occupies 3.0% of the world's leather and leather products market by volume [2]. During 1970s tanneries were started to establish in an unplanned way beside the mighty river Buriganga having no effluent treatment plant (ETP) and resulted severe pollution of that river [3], [4]. In 2017, all the tanneries were shifted in a planned way from the Hazaribagh to Savar tannery village adjacent to the Dhaleswari River with setting of a central effluent treatment plant (CETP), which was not fully functional from the beginning [5]–[8].

Dhaleshwari River, the primary left bank of the Jamuna River is flowing alongside central Bangladesh and contributes tremendously to the socio-economic prosperity of surrounding region and the country. A number of previous researches reported that the physico-chemical properties of Dhaleshwari river water deteriorating after the shifting of tannery factories [2], [6], [8]. Massive quantities of liquid effluents such as organic matter, chromium (Cr), sulphide and solid wastes (fleshing, trimmings, shavings, buffing dusts) are producing from light leather manufacturing and difficult to dispose of [9], [10]. Around 60% of the overall chromium salts react with the hides, and about 40% of the chromium is left in the solid and liquid wastes[11]. Chromium is dangerous to humans, animals, and the environment [9], [12], [13]. To reduce the effect of tannery waste in the aquatic environment organic matter, solids, nutrients, and other contaminants like BOD, COD, TSS, TDS, and Cr levels need to keep acceptable level [4]. Because of the existence of a number of chemicals with low biodegradability, treating tannery effluent is difficult and poses a significant environmental and technical issue, also become a major concern of the country [14].

The Department of Environmental Science and Disaster Management (ESDM), Daffodil International University, Bangladesh has been initiated a research work to identify the water pollution along the rivers of Dhaka city, Bangladesh. In this context the water quality of Dhaleswari river, Dhaka, Bangladesh has been analyzed in the ESDM laboratory. The objective of this work is to analyze the water quality of Dhaleswari river, and the probable suggest some solutions to control the water pollution along in that river.

2. Methodology

2.1 Study area

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. The process of relocating tanneries from been completed in the year 2017. Establishment of infrastructure at the 200-acre tannery estate has been completed.

The Dhaleshwari River is a distributary, 160 km long, of the Jamuna River in central Bangladesh. It starts off the Jamuna near the northwestern tip of Tangail District. After that it divides into two branches: the north branch retains the name Dhaleshwari and merges with the other branch, the Kaliganga River at the southern part of Manikganj District. Finally the merged flow meets the Shitalakshya River near Narayanganj District. This combined flow goes southwards to merge into the Meghna River. Average depth of river is 122 feet (37 m) and maximum depth is 265 feet (81 m).

Being at the central part of the country, Dhaleshwari has many industries, mills and households on its bank, all of which serve as a potential source of degradation of its water quality in one way or another. As per objective, the study was conducted on the specified segment of the Dhaleshwari river in the vicinity of the Savar Tannery Industrial Park. This segment is bounded on the North-

East by the Dhalla Bridge (approximately 2 km in the upstream side from the industrial park area) and the South-West by Alipur Bridge (approximately 2 km in the downstream side from the industrial park area). As a whole, in the vicinity of Savar Tannery Industrial Park, a total of 5 km stretch of the river was covered.

The water samples were collected by Field work. Field work has been carried out along the Dhaleshwari river from three selected areas- upstream, polluted and downstream areas. The sample collection areas were selected on the basis of literature review and preliminary research. Water samples were collected in sample bottles after rinsing with diluted Nitric acid (HNO3). To avoid surface debris water samples were collected approximately 50 cm below from the river surface and immediately brought to the laboratory for further analysis.

2.2 Laboratory analysis

The physico-chemical parameters of water samples were analyzed following standard methodology [15]. The water samples were segmented on the collection site and named as upstream, polluted area and downstream. The analyzed parameters included pH, Electrical Conductivity (EC), Total Dissolved Soild (TDS), Dissolved Oxygen (DO), salinity, Chemical Oxygen Demand (COD), Total Chlorine (Cl^-), Chromium Hexavalent (Cr^{6+}), Chromate (CrO_4^{2-}) and Dichromate ($Cr_2O_7^{2-}$) ion.

3. Results and Discussions

Physico-chemical parameters of the aquatic environment are considered as one of the most important factors which are capable to influence that environment [16]. The pH and DO of the water samples collected from upstream, polluted area and downstream area ranged from 6.77-6.83 and 6.2-7.1 (mg/l) respectively. High level of EC was found in both polluted area-300 (µS/cm) and downstream area, 310 (µS/cm) compared to upstream area 260 (µS/cm). Electrical conductivity is the measure of the ability of an aqueous solution to transmit an electric current in the aquatic environments [17]. High level of EC denoted the area is being polluted by waste.

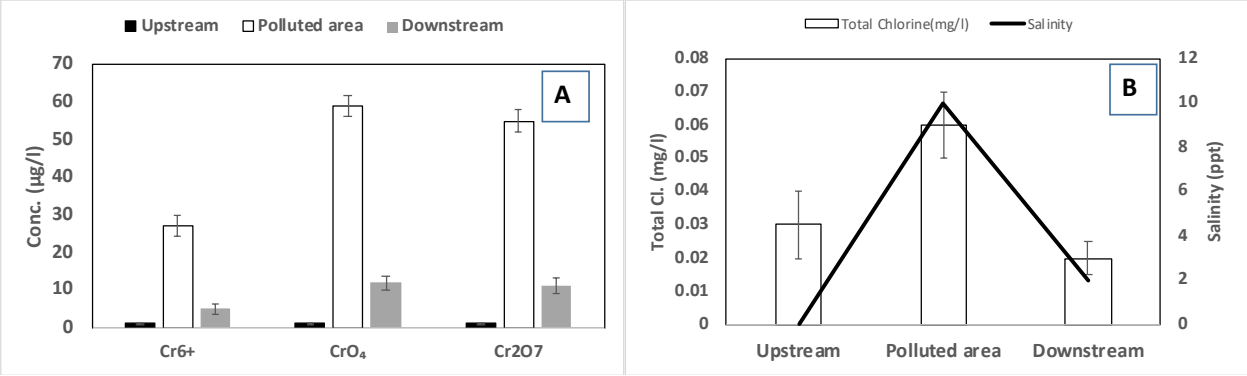

Figure-1: Cr^{6+}, CrO_4^{2-}, $Cr_2O_7^{2-}$ concentration (A); and total Cl and salinity concentration (B) of upstream, polluted area and downstream area.

Total dissolved solids (TDS) are the materials dissolved in water like bicarbonate, sulfate, phosphate, nitrate, calcium, magnesium, sodium and organic ions [16].In the present study high levels of TDS were observed in polluted water 310 mg/l and downstream Water 266.7 mg/l. The reason for high TDS along the river might be the textile effluent debris, agricultural runoff and liquid waste from urbanization.

Chemical Oxygen Demand (COD) is an important parameter for waste water to measure the amount of oxygen that is required to break down pollutants (organic substances) in water. Higher COD levels expressed greater demand for oxygen to break oxidizable organic matter, which ultimately reduce dissolved oxygen (DO) in Aquatic body. So, less COD in aquatic area denoted waste free water. High level of COD was observed in both polluted and downstream water.

Concentration of Cr^{6+}, CrO_4^{2-}, $Cr_2O_7^{2-}$ significantly varied in polluted water condition compare to River Water, which confirmed that the water is polluted with tannery effluent discharged by leather industry around Savar area. In the present study, concentration of most of the analyzed parameters in polluted area found lower compared to previous work [2], [6]. COVID 19 pandemic may act as a reason behind this. Due to the pandemic a country wide lockdown was imposed for 2/3 months and most of the industrial sectors could not run their general production. As a result, the pollution level of Dhaleshwari river water reduced compared to previous analysis.

4. Concluding Remarks

The present study confirmed that Dhaleshwari river water is being polluted by Tannery effluent. To achieve SDG Target 6.3: Improve water quality, wastewater treatment and safe reuse the Government of Bangladesh should take immediate action to improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse.

5. References

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