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Research Paper

Assessment of heavy metals and water quality parameters of Buriganga river of Dhaka, Bangladesh: A review

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ABSTRACT: *The intention of this work is to mark out the literature survey of water pollution of Buriganga River. Themethod used for this write-up is a survey of scholarly journal articles, web materials, academic books, conference papers, project reports and freely accessible materials on the Buriganga river water pollution. All previouswriters whose works werechecked,concurredon water pollution and spatial variation of physicochemical parameters over time and location more than other sources in terms of both chemical and physical water toxins that shownuplifted values of majorchemical parameters (lead, cadmium, chromium, copper and some anions) beyond the acceptable/lower limits set by administrative bodies. Authors also agreed on the issuethat human, aquatic and physical environment are in alarming situation due to rising values of chemical parameters. From the survey and analyzing the output of past studies, we can conclude that Buriganga river is polluted and water must be treated before use both fordomestic and industrial purposes to avoid the spread of epidemics. Proposals of the scrutiny incorporate: (1) consistentsurvey of Buriganga river water pollution; (2) strict organization of directions water quality benchmarks and (3) Well-planned monitoring of the environments of water bodies by authorities and the local people.*

KEYWORDS:*Physicochemical Parameter, heavy metals, Buriganga river,Environmental Flow*

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I. INTRODUCTION

Quality of water notices to the factor of water, which is to be shown at the perfect level for satisfactory development of humans, plants and animals. Differentparameters like temperature, turbidity, nutrients, hardness, alkalinity, dissolved Oxygen play an imperative part for creatures in the water body, on the other hand biological Oxygen demand, chemical Oxygen demand appear the contamination level of the water. In normal aquatic framework, different chemical parameters happen in truncated concentration.This concentration increases as a result of fast development of urbanization, diversification of industrial activities, ill treatment of natural resources and lack of environmental management.

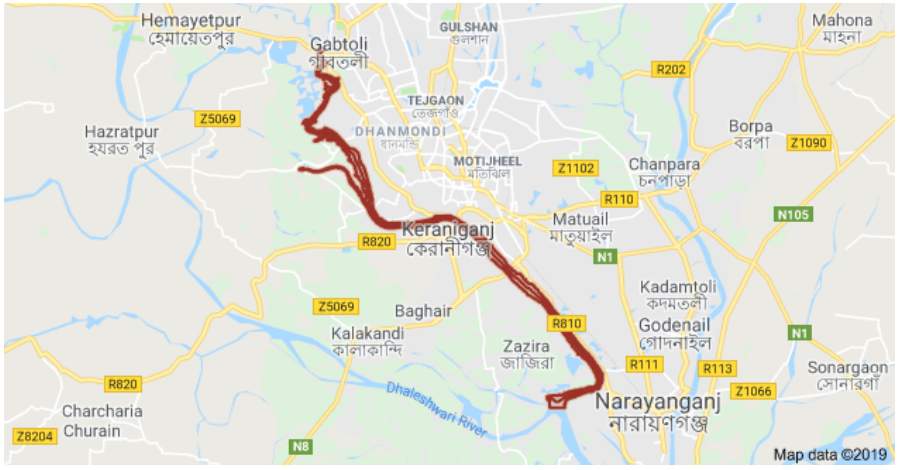

Figure 1: Buriganga river from Google map

Buriganga is a black river streams past the southwest edges of Dhaka city, the capital of Bangladesh, which plays a vital part for the capital. This river gets all sorts of domestic wastes through junks outfall, unprocessed sewage being discharged into the Buriganga River. Each day Dhaka's 12.6 million individuals create about 3,200 tons of solid litter, most of which goes into the stream. And every day up to 40,000 tons of unprocessed tannery waste is discharged specifically into the waterway [1], which contains different natural and inanimate supplements and other poisons. These toxins cannot be extracted due to its ephemeral character and hence they are gathered in the river system gradually. Most distributed information on the impacts of toxins on aquatic organisms however gives the report of antagonistic impacts at concentration higher than worthy constrain (GESAMP, 1985)[2].

The following review article portrays the outcomes of the work accomplished by different analysts in the past on the heavy metal contamination and water quality parameters of river Buriganga.

II. WATER QUALITY PARAMETERS AND HEAVY METAL POLLUTION

On the bank of Buriganga river, 343 tannery industries are situated[3]. Tanneries in the city's Hazaribagh rangereleasea few 21,600 square meters of liquid wastes regular into the Buriganga River [4].These deleterious effluents, including chromium, lead, Sulphur, ammonium, salt and other materials, are extremely contaminating the Buriganga River [5].Adjacent to the Buriganga river near jingira, karanigang ranges, 627 dyeing industries are located [6].Theseindustries discharge 5000 square meters of effluents each day into the Buriganga river.These effluents are consisted of some harmful chemicals such as epoxy, polyurethane, enamel, ductile-silvery white metal,hydrochloric acid, alkalis, lime, caustic soda, aluminum, zinc chromate, zinc phosphate, asbestos etcetera[7].Besides all, 104 notable fertilizer industries are inFatulla, Faridabad, Bosilla, Damraadjacent to Buriganga River and these industries are liable for discharging approximately 9000 square meters of effluentseveryday into the Buriganga River [7]. Over 80,000 cubic meters of untreated industrial wastes are dumped every day into the Buriganga. Tens of thousands of people are using the Buriganga riverways every day to and from different far-flung areas of the country's southern districts, including greater Barisal, Bhola, Patuakhali and Chandpur boarding on several launches through Sadarghat point in the old part in the capital. [9].Therefore, further study is required to evaluate the existing water quality of this river.

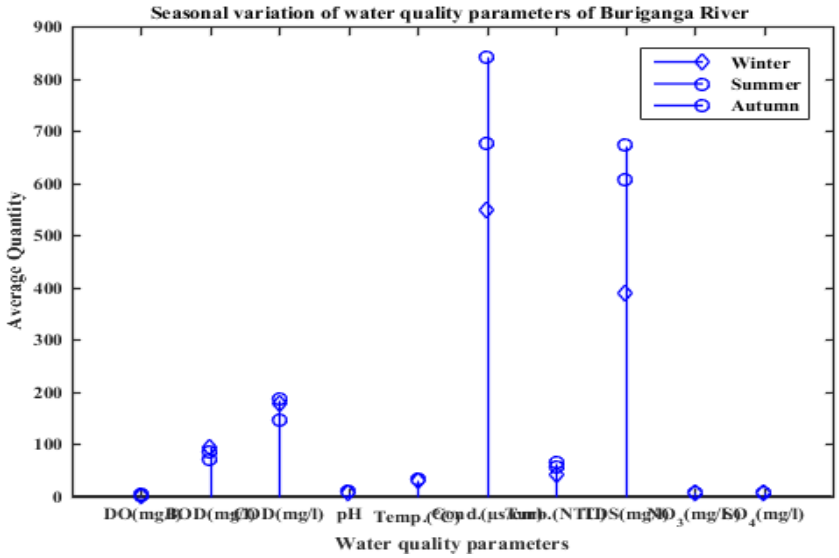

Figure2: Distinctive water grade parameters of Buriganga River in Winter, Summer and Autumn. (Note: Source: Ahammed et al. (2016))

Ahammed et al. (2016) studied the water grade of Buriganga -a river streaming through Dhaka [10].The water gradevariables specify that the standard of water in Buriganga river is very imperfect.The measurement of average DO, BOD and COD was 1.11 mg/L, 82.30 mg/L and 148.45 mg/L respectively and the accumulation of nitrate and phosphate was 5.92 mg/L and 5.83 mg/L respectively. Nitrate and phosphate values are from a non-point source of pollution while the DO, BOD and COD show that these values are more symbolic of point sources of pollution.

Ahmed et al. (2011) investigated physicochemical properties of tannery and textile Effluents and surface water of river Buriganga and Karnatoli, Bangladesh [11].As well as he analyzed the physicochemical properties such as Biological Oxygen Demand (BOD), salinity, Total Dissolved Solid (TDS), Total Suspended Solid (TSS), Sodium (Na+), Potassium (K+), Calcium (Ca^{2+}), Iron (Fe3+), Phosphate (PO), Chloride (Cl-),

Nitrite (NO) and Nitrate (NO3) of tannery effluent.The seven variables in the tannery and textile effluents are immoderate than the DoE Standard suggested for open water, however, only BOD_5 these values were within range in the surface water of Buriganga rivers.

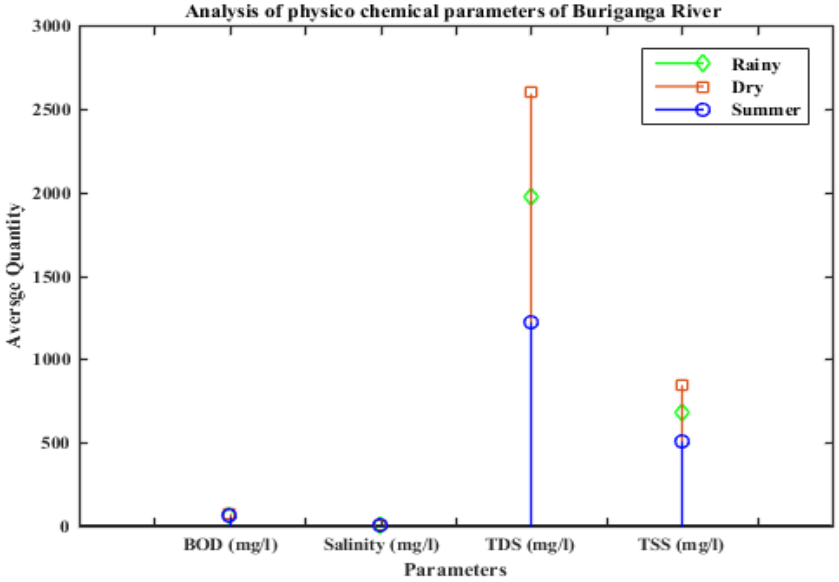

Figure 3: Water gradevariables of Buriganga River. (Note: Source: Ahmed et al. (2011)

Table 1: Confinement of heavy metals in drinking water [12].

Heavy metal	Permissible limit				
	WHO	USEPA	ISI	CPCB	ICMR
Iron (mg/l)	0.1	-	0.3	1.0	1.0
Cupper (mg/l)	1.0	1.3	0.05	1.5	1.5
Mercury (mg/l)	0.001	0.002	0.001	No relaxation	0.001
Cadmium (mg/l)	0.005	0.005	0.01	No relaxation	0.01
Arsenic (mg/l)	0.05	0.05	0.05	No relaxation	0.05
Lead (mg/l)	0.05	-	0.10	No relaxation	0.05
Zinc (mg/l)	5.0	-	5.0	15.0	0.10
Chromium (mg/l)	0.1	-	0.05	0.05	No relaxation

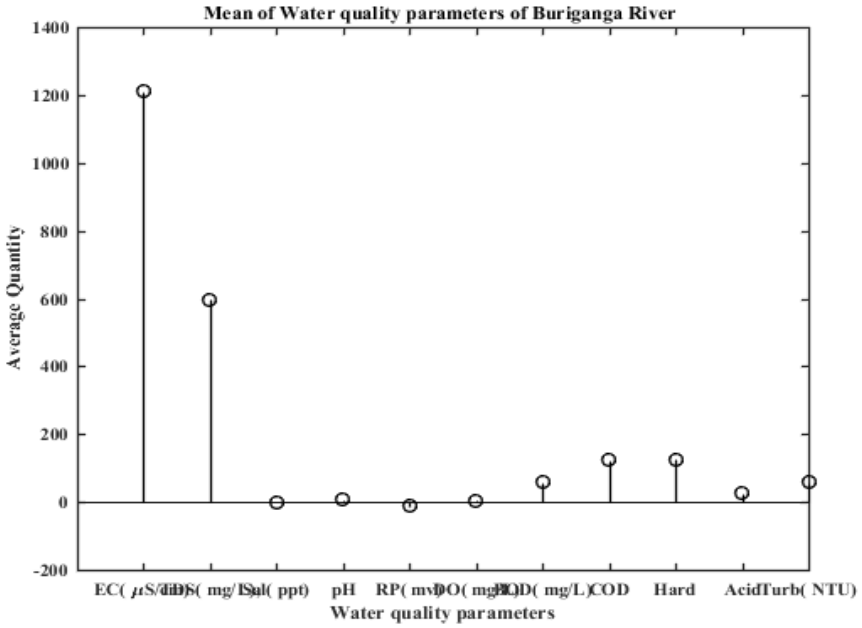

Figure 4: Water gradevariables. (Note: Source: Akbor et al. (2017))

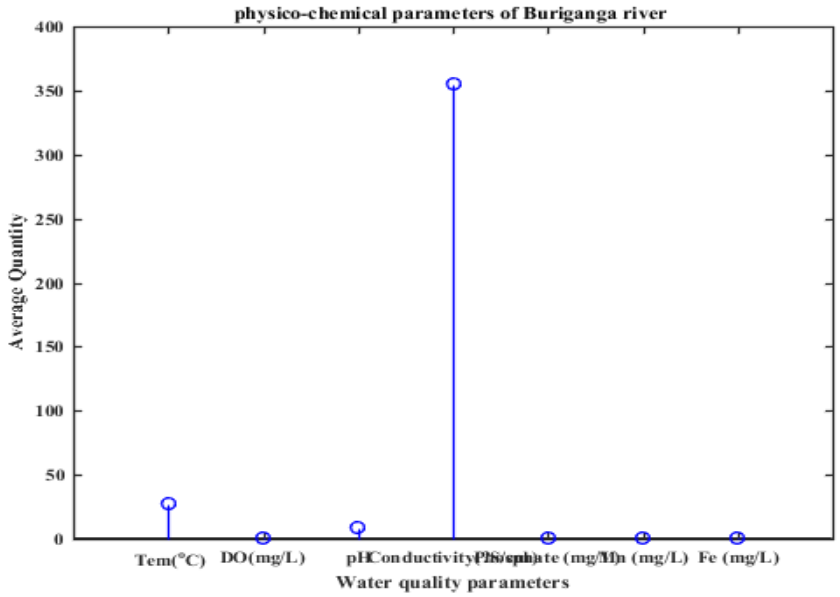

Figure 5: Physicochemical variables of Buriganga river. (Note: Source: Fatema et al. (2018))

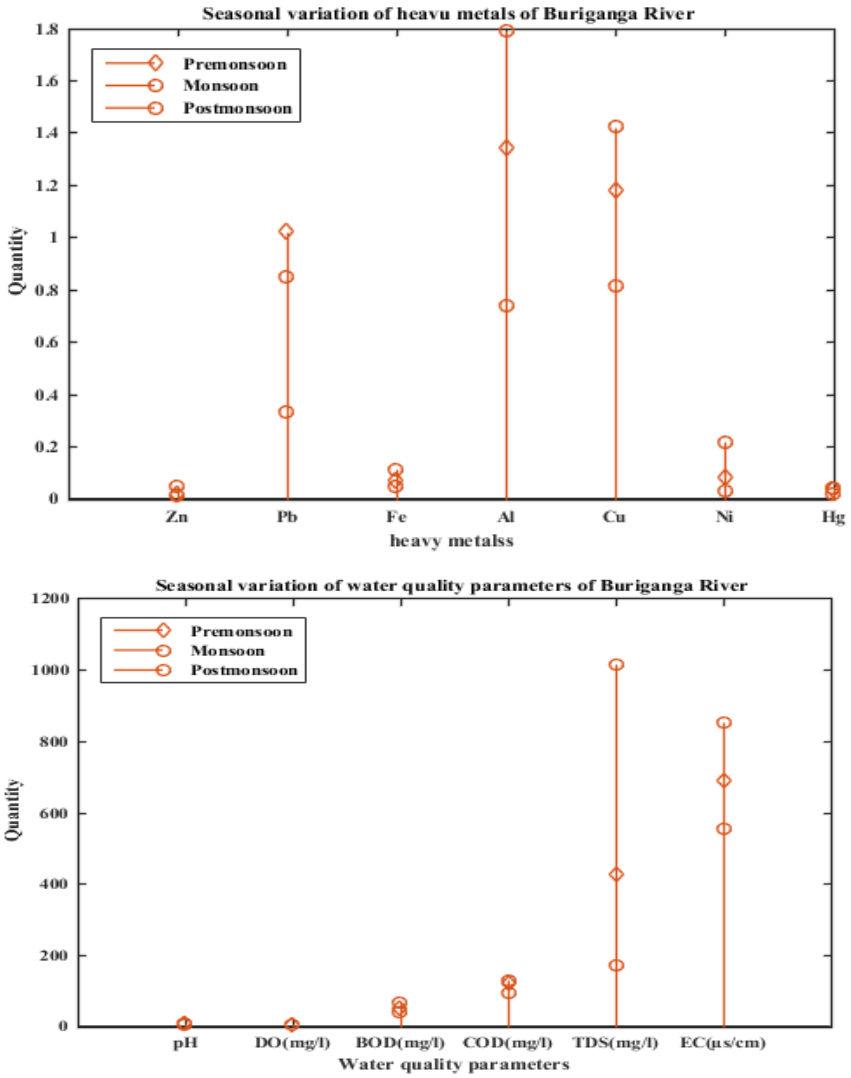

Figure 6: Seasonal fluctuation of water grade parameters and heavy metals of Buriganga river (Note: Source: Islam and Azam inspected (2015)).

Investigation of water grade parameters at various points in the Buriganga River have been analyzed by Akbor et al. (2017) [13]. The analysis described that the water of Buriganga river is highly concentrated in biological oxygen demand (BOD), chemical oxygen demand (COD), Electrical conductivity (EC), Total dissolved solid (TDS), Salinity, Alkalinity, Turbidity and little in dissolved oxygen (DO).

Fatema et al. (2018) scrutinized water grade evaluation of the river Buriganga, Bangladesh [14]. This analysis reveals that the water grade of the river Buriganga is being contaminated from its neighboring point and non-point roots with local wastewater and liquid waste that is sent out from different factories. Constantly strict observing of water grade is mandatory to protect the Buriganga river.

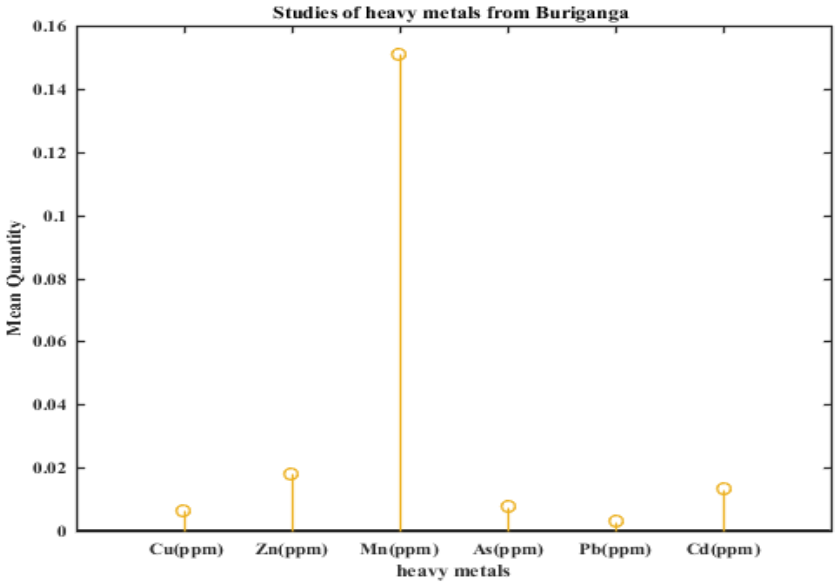

Figure 7: Heavy metals of Buriganga River(Note: Source: Mokaddesetal. (2013)).

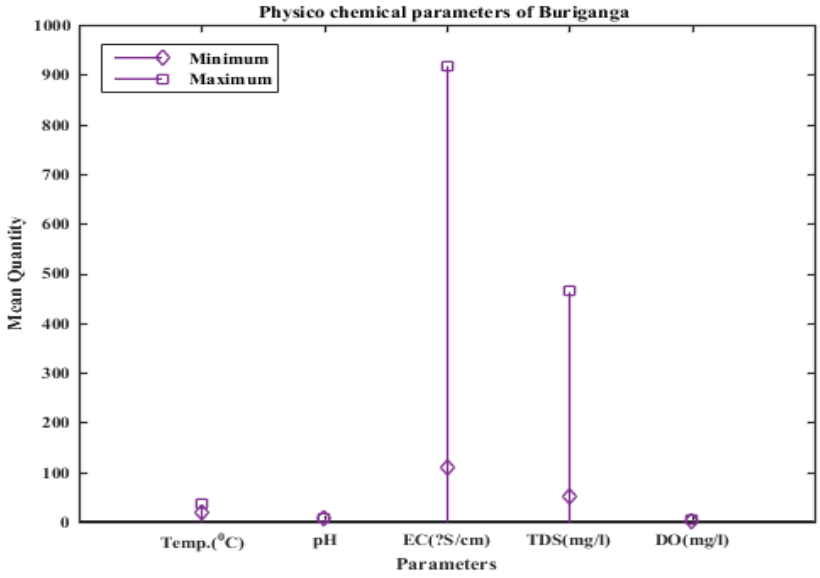

Figure 8: Average water gradevariables in water of Buriganga River. (Note: Source: Mokaddes et al. (2013)).

Hafiz et al. (2017) explored assessment of instream flow requirement based on oxygen demand of Dhaka peripheral river system [15]. Authors have found the maximum monthly BOD varies from 11.51 to 23.40 mg/l in pre-monsoon, from 3.35 to 4.54 mg/l in monsoon and from 3.36 to 18.67 mg/l in post-monsoon in the Turag river. They suggested that Government should take this issue seriously and should take immediate action to relocate the tanneries and industries from the bank of the Dhaka peripheral river and establish Effluent Treatment Plant (ETP) to treat the existing condition.

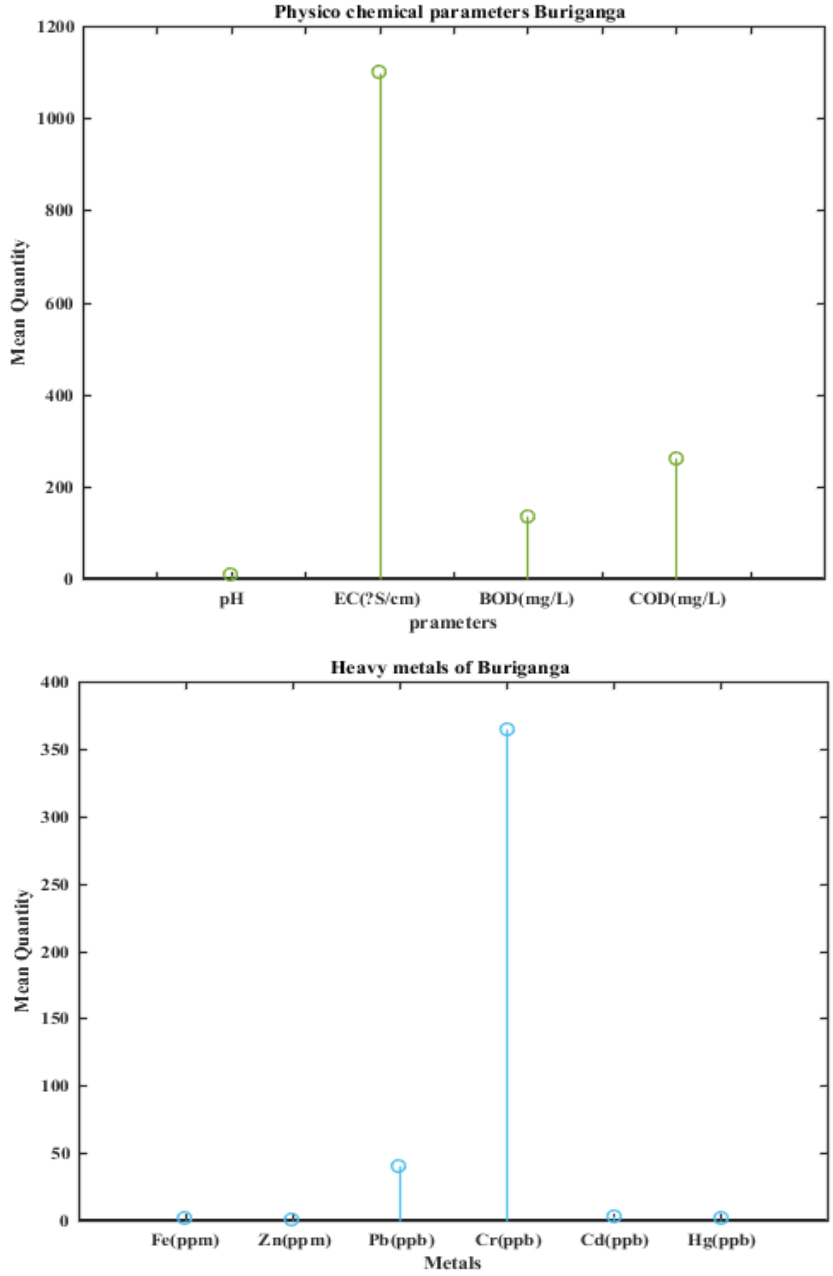

Figure 9: The summary of physicochemical characteristics of Buriganga river (Note: Source: Mottalib et al. (2017)).

Hasan et al. scrutinized (2013) an assessment by comparison of water grade in the peripheral rivers of Dhaka city. Authors disclosed that through the period of drought mainly from December to February (winter), the excessive values of parameters regarding suitable limits of DoE and USEPA standard remark the contamination of the river water samples and make the water incompatible for uses [16].

Hoque and Deb studied (2016) on, evaluation of physicochemical water grade variables and heavy metals intensification in water samples from Buriganga River nearby Dhaka city. Authors discovered that estimated water grade variables and intensification of heavy metals were outperformed the worth level determined by ECR and ADB [17]. Compared to other heavy metals concentration, chromium and cadmium were 4-5 times higher than the marked level. Seasonal variation of physicochemical and toxic properties in three major rivers; Shitalakhya, Buriganga and Turag around Dhaka city, Bangladesh, have been inspected by Islam and Azam (2015) [18].

Authors calculated Water Quality Index (WQI) from water grade parameters, that is repeatedly estimated round a year at three sampling sites of each river. Authors noticed seasonal order of pollution

magnitude and relatively better water grade was found in monsoon while during post monsoon the conditions were critical.

Kibria et al. (2015) considered Buriganga river pollution: its causes and impacts [19]. Authors found the reasons for contamination of Buriganga are excessive population, invasion and expropriation of land, dumping of trash, spontaneous tannery factories etcetera. Also found extreme debasement of water grade that is very harmful to the surroundings and can have disastrous effects on delicately balanced river ecosystem.

Mokaddeset al. (2013), reviewed condition of heavy metal pollutions of river water of Dhaka metropolitan city [7]. Writers culminated from the research that the rivers of Dhaka city contained suitable amount of As, Zn, Pb, Cd where Mn surpassed the proposed boundary for potable water, public water irrigation water and for hydroponics.

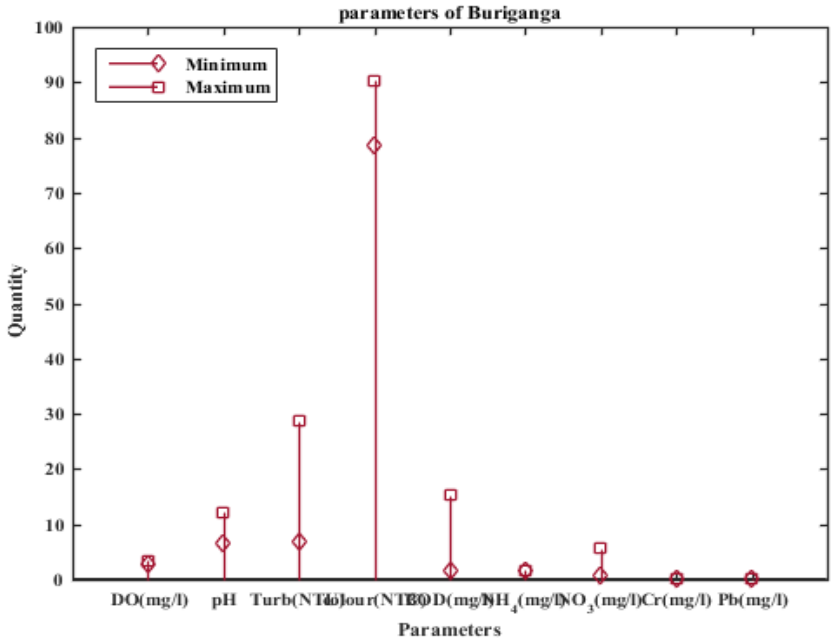

Figure 10: Average concentration of water quality parameters at Buriganga river (Note: Source: Pramanik and Sarker (2013)).

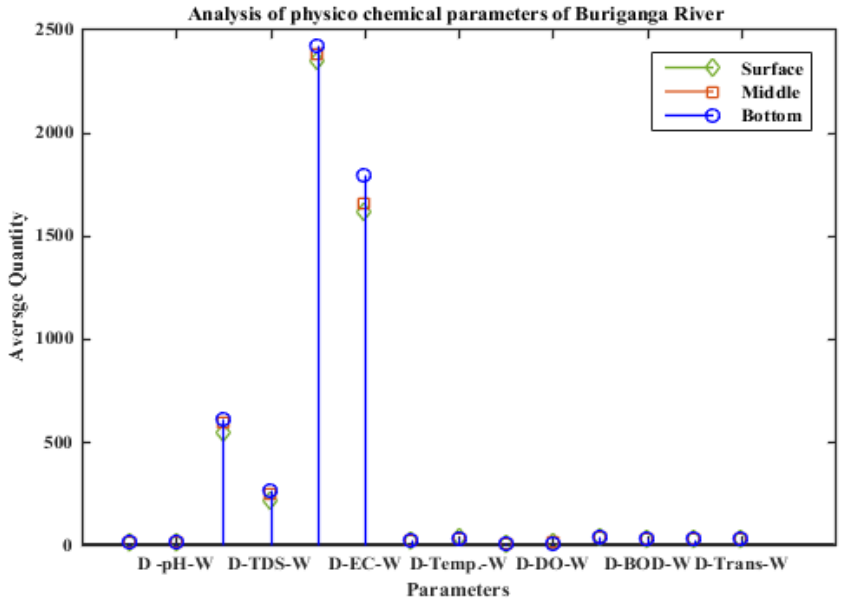

Figure 11: Physicochemical parameters during the period of drought and Wet season (Note: Source: Saifullah et al. (2012)).

Moniruzzama et al. (2009), studied on temporal variation of physicochemical parameters of Buriganga river water through GIS (Geographical Information System) technology. Authors reveal that in the period of drought the intensity of pollution is higher compared to the rainy season. That specifies the water of

Burigangawas not safe for drinking purposes, irrigation, fisheries, recreational activities and various industrial uses for most of the times of year [20].

Mottalib et al. (2017) scrutinized a study by comparison on water grade of Buriganga and Balu river Dhaka, Bangladesh. Authors finding Buriganga river is polluted by many sources like leather industries and from these industries inorganic and organic pollutants discharged into Buriganga River regularly without any treatment [21].

Pramanik and Sarker (2013) experimented on assessment of surface water grade of the Buriganga River [22]. Writers analyzed that the intensity of contamination of Buriganga river is increasing keenly. So, within a couple of years, extreme water grade downturn could occur.

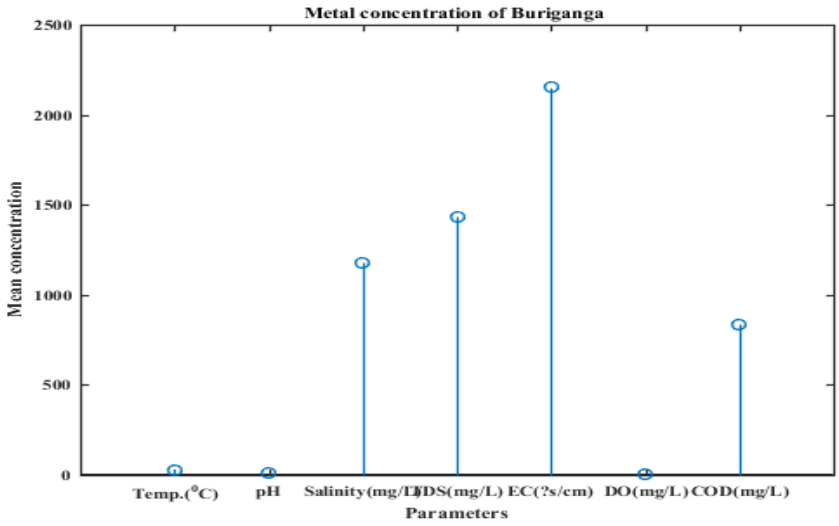

Figure 12: Water grade parameters of the Buriganga River (Note: Source: Sarkar et al. (2015)).

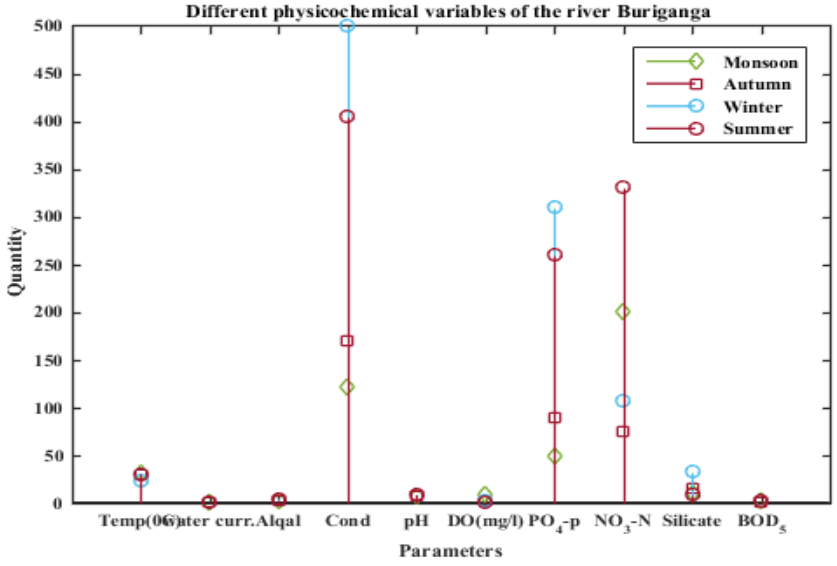

Figure 13: Water grade variables of the River Buriganga (Note: Source: Zerin et al. (2017)).

Rahman and Bakri (2010) conducted a research on some selected water grade variables across the Buriganga river of Bangladesh.Authors reveal that from aquatic environs perceptions, for the parameters such as DO, BOD_5, COD, NH3-N and Cr during both dry and wet seasons and for EC during the dry season, the water grade of Buriganga River is not up to the mark [23].

Rahman et al (2013) researched on heavy metal contamination in circumferential river water around Dhaka City [24]. Authors decision is that the absorptions of heavy metal in the stream are very exorbitant compared to Bangladeshi caliber for potable water (ECR, 1997) [4].

Saifullah et al. (2012) explored inspection of some water grade variables of the Buriganga River. Widespread removal of local and industrial junks is contaminating the water of Buriganga river. The oxygen

concentration in the water environs become very low at some locations of the river due to the contamination of water bodies by chemical and organic wastes [25].

Chemical hydrology and contamination level of Buriganga river have been scrutinized by Sarkar et al. (2015). This article elucidates the current contamination level of the Buriganga River by analyzing temp., pH, salinity, EC, TDS, DO and COD. Water of Buriganga river is contaminated by the DoE recommended values for EC, DO and COD. Therefore, for the purpose of drinking, household, irrigation and industrial activities, the water is completely incompatible to use [26].

Zerin et al. (2017) juxtaposed water grade evaluation of Buriganga river nearby Dhaka city [27].

III. ENVIRONMENTAL FLOW

Hafiz et al. (2017), analyzed simulation of hydrodynamic parameters of Dhaka peripheral river system of Bangladesh [5]. It has been seen by the authors, the pace of the rivers in the rainy season is acceptable whereas in the period of drought it becomes 0. Hence the stream of the river is falling flat day by day. Steps should be taken to augment the flow of Dhaka peripheral system to maintain the ecological.

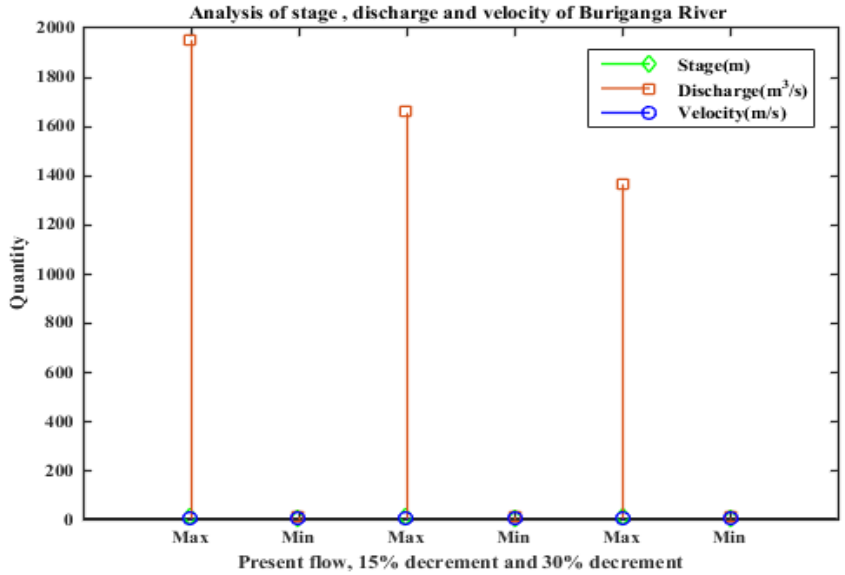

Figure 14: Maximum and minimum values of the hydrodynamic parameters of Dhaka peripheral rivers for 15% and 30% decrement of upstream flow. (Note: Source: Hafiz et al. (2017))

IV. CONCLUSION

In early 2018 most of the tanneries are reallocated to Savar Tannery park from the bank of Buriganga river, still one of the highestcontaminated river in the living world.Some small tanneries still operate on the Buriganga secretly. Dying factories are still biggest risk at the Shampur area. Dhaka WASA (Water Supply and Sewage Authority), proceededillegal tannery functioning and other wastes that are coming from factories and household activities[28].

Though tanneries are replaced from bank of Buriganga river stillwritersinvestigated that the river is denselycontaminated. So rapid growth of urbanization and corresponding challenges affecting our aquatic ecosystem. The metals get the entrance to the environment through aquatic life frameworks and plants and animals adjacent to the river. The risk of gradual accumulation of substances in living organisms and bioamplification of the pollutant shows a great threat to mortal robustness and well-being. Subsequently, necessary steps should be taken to diminish the effluent load kept into the waterway.

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