The International Journal of Engineering and Science (IJES)
|| Volume || 6 || Issue || 9 || Pages || PP 45-48 || 2017 ||
ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805

Seasonal Variations and Assessment of Oxygen Demanding Parameters (DO, BOD, COD) in Solmari River, Bangladesh

Md. Nazim Uddin[1,*], A.H.M. Nasimul Jamil[2] and Md. Shamim Reza[3]
[1,2]*Department of Chemistry, Khulna University of Engineering and Technology, Khulna, Bangladesh.*
[3]*Department of Chemistry, North Western University, Khulna, Bangladesh.*
Corresponding author: Md. Nazim Uddin[1]

ABSTRACT
This study examined the Dissolved Oxygen (DO), Biological Oxygen Demand (BOD) & Chemical Oxygen Demand (COD) in summer, rainy& winter season to assess the water quality and sessional variations of Solmari River, Bangladesh. The highest DO value was observed in rainy season than winter or summer season. But the BOD and COD was high during winter and rainy season. This high level of BOD and COD value in summer season indicates the presence of a large number of microorganism's i.e. high level of pollution. The parameter COD is more preferable to BOD because it is a quickly measurable parameter.
Keywords: Seasonal variation, Water assessment, Solmari River, DO, BOD and COD.

Date of Submission: 10 JUL 2017 Date of Accepted: 17 SEP 2017

I. INTRODUCTION

Water is undoubtedly the most precious natural resource that exists on the planet. It is the most valuable and vital resource for sustenance of life and also for any developmental activity [1].The water quality of River varies from time to time due to interaction of various local factors and environmental causes. The River water has been used for agriculture, fishing, drinking, industrial production and aqua culture etc. Rivers and their landscapes are complex ecosystems that can be seen as an interaction between five main components: physical habitat, the energy or food base of the system, flow regime, biological interactions and water quality.

All contribute to the maintenance of the biological or ecological integrity of the system which refers to the capacity to support and maintain a balanced, integrated and adaptive biological system having the full range of elements and process excepted in a region's natural habitat [2]. River pollution becomes apparent at times during accidents through horrifying scenes of dead fish floating on the surface of water. But more often, it exists as chronic and insidious pollution originating from different human activities. Pollution causes a general deterioration in the state of health of rivers across the entire planet. The growing problem of river pollution has necessitated the monitoring of the Water quality of the river in different states of our country to restore the waste quality.

Bangladesh is a land of Rivers. Around 230 Rivers flow in the country including 53 international Rivers. Solmari River is one of the important Rivers of the River system networks across the coastal belt Khulna, Bangladesh. The River Solmari is a very old River, which flows through Batiaghata upazila and separates "Zolma" union from Batiaghata. It starts from Rupsha River and finally falls into the Bhadra River. The River has several tributaries and adjacent villages. So, the geographical location of this River is very significant along with ecological perspective. Human beings are using the land for various purposes. Due to these activities, the water characteristics can be influenced through taking a huge agricultural runoff and other unwanted wastes. Moreover, assessment of water quality of any region is an important aspect of developmental activities, as Rivers are used for water supply to domestic, industrial and agricultural purposes [3]. Keeping all this aspect in mind, the present study was designed to investigate seasonal variation and assessment of oxygen demanding parameters DO, BOD and COD, which could adversely affect the plants and animals, including aquatic habitat in Solmari River, Khulna.

II. EXPERIMENTAL METHOD

The study:

The study area Solmari River is located in the South-West part of Bangladesh and within 22°45'55.6" to 22°49'40.4" North latitude and 89°28'19.0" to 89°32'53.7" East longitude (fig. 1). It is about 15.0 km long. Being a coastal river, it faces diurnal tidal fluctuation that allows sea water mixing with the fresh water. The water samples were collected from four stations along Solmari River. The selected sampling sites were Batiaghata bazar, Uttorpara Kheya Ghat, Solmari Kheya Ghat and Dhanibunia. Those stations are described in table 1.

Table 1: Location, Latitude, Longitude & sample ID of the sampling points

Sl. No	Location	Latitude (North)	Longitude (East)	Sample ID
1	Batiaghata bazar, Khulna	22°49'40.4"N	89°32'53.7"E	S-1
2	Uttorpara Kheya Ghat, Khulna	22°48'11.2"N	89°31'21.4"E	S-2
3	Solmari Kheya Ghat, Khulna	22°46'32.3"N	89°29'46.9"E	S-3
4	Dhanibunia, Khulna	22°45'55.6"N	89°28'19.0"E	S-4

Sample collection:
Water samples were collected from four different sites based on the characterizing features of the location along the Solmari River; Summer season (March, 2016 to April, 2016), Rainy season (July, 2016 to August, 2016), winter season (December, 2017 to February, 2017) and in the year of 4thMarch, 2016 to 12thFebruary, 2017with fortnightly variations. The samples were collected from each site both in high tide and low tide from near about 10 cm depth from the surface of the Solmari River. The purpose of sampling was to handle the water sample very carefully in such a way that no significant changes occur in composition before the tests are made. The bottles were properly labeled with the sample number and date of sampling and were put in the bag to carry them to the area of testing. The bottles were tightly closed after being filled & stored at room temperature.

Analytical Method set-up and Statistical analysis:
In the experimental works, all of the parameters were measured by using standard titration methods (Table-2)[4]. Replicate analysis of water sample was performed during the study to avoid errors. Data was statistically analyzed by using One Way ANOVA (Software SPSS-15) at 5% level of significance among various spot and different seasons.

Table-2: Methods used during these investigations

Parameters	Method used for estimation/Instrument
Dissolved Oxygen (DO)	Winkler's method
Biological Oxygen Demand (BOD)	Winkler's method
Chemical Oxygen Demand (COD)	Reflux Titration method

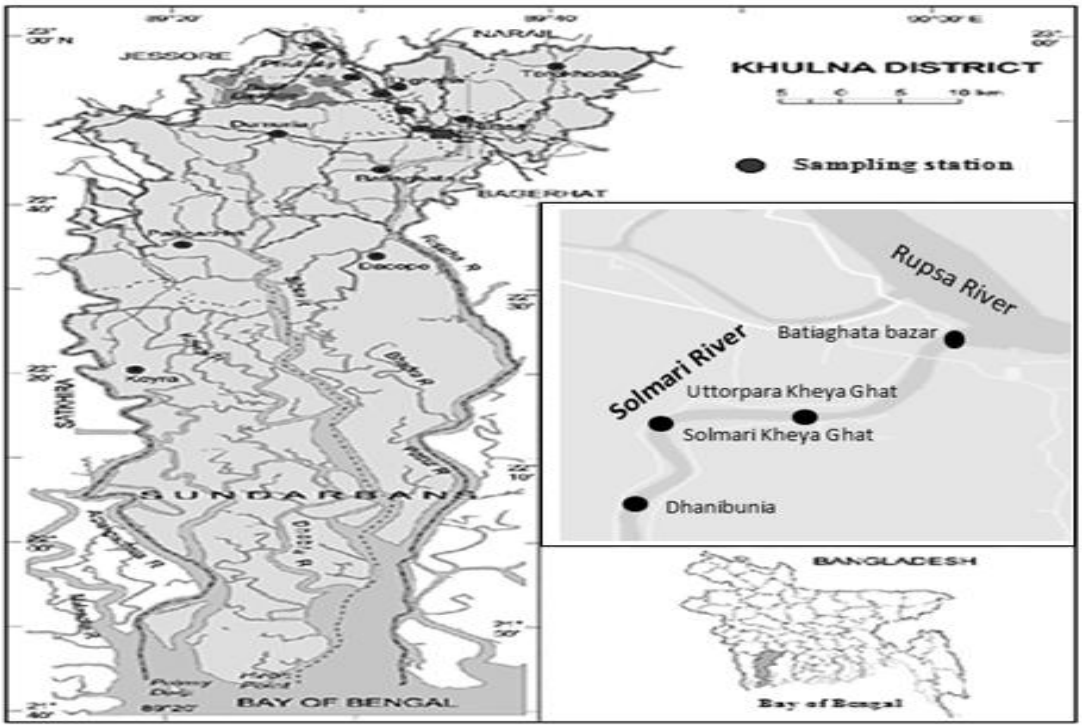

Figure 1: Map of the study area indicating the sampling station (source: Banglapedia)

III. RESUTTS AND DISCUSSION

Dissolved Oxygen (DO):
Dissolved oxygen (DO) is present in water in the form of a dissolved gas. Dissolved oxygen is one of the most vital parameters in water quality assessment and reflects the physical and biological processes prevailing in the water [5].DO levels of 6 mg/l are considered optimal for proper growth of fish and other aquatic life. As

dissolved oxygen levels in water drop below 5.0 mg/l, aquatic life is put under stress. Most fishes cannot survive for prolonged periods at DO levels below 3 mg/l [6].Oxygen-demanding organic matter particularly requires the oxygen from water for the process of decomposition. More organic waste in water results in to decrease in average DO concentrations. However, in water bodies where a large proportion of the organic matter is brought in from outside the water bodies, the oxygen production and consumption are not balanced and DO may decrease [7].Fig. 2.1 reveals that DO was high during rainy season following by winter and summer. In summer season, DO ranged was between (4.69-5.61) mg/L with maximum value at S-3 (5.61 mg/L). In rainy season, DO was varied between (7.94-8.97) mg/L showing maximum value at S-3 (8.97 mg/L) and in winter, DO was varied between (6.04-7.02) mg/L with maximum value at S-3 (7.02 mg/L). Increased DO level during monsoon is in accordance with the research findings [8-10]. Increased value of DO during rainy season was attributed to the addition of fresh water in rainy days. An ideal DO value of 5.0 mg/L is the standard for drinking water [11]. DO was found to be in permissible limits at all the study sites among various seasons, therefore water is of good quality for aquatic life. Significant variations ($p<0.005$) were observed among various seasons.

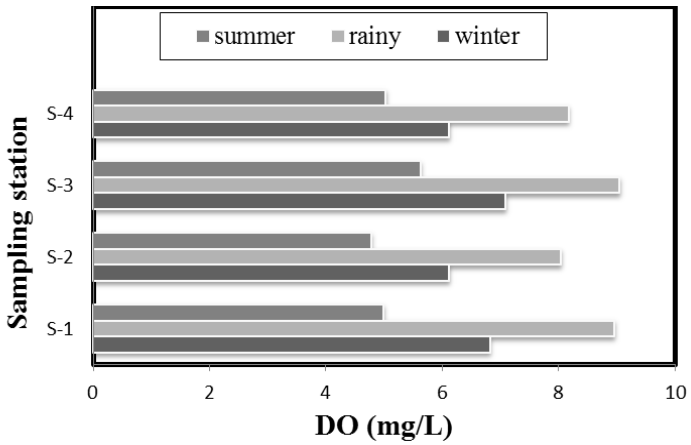

Fig.2.1: Seasonal variations in concentration of Dissolved Oxygen (DO) in Solmari River, Khulna, Bangladesh.

Biological Oxygen Demand (BOD):

BOD is the amount of the oxygen required by microorganisms for the decomposition of the organic matter present in water. Therefore, it reflects the amount of organic pollutants in water. A high BOD value indicates the presence of a large number of microorganisms, which shows a high level of pollution [12]. It involves the measuring of differences in oxygen concentration in the water sample before and after incubating it for 3 days at 27ºC. Fig. 2.2 reveals that BOD was high during summers following by winter & rainy season. In summer, BOD was ranged from (10.51-12.41) mg/L with maximum at S-3 (12.41 mg/L). In monsoon, BOD was varied from (9.29-10.54) mg/L with maximum at S-3 (10.54 mg/L) and in winter, maximum, BOD was varied from (9.72-11.64) mg/L with maximum at S-3 (11.64 mg/L). Significant variations ($p<0.005$) occur between summer & monsoon and summer & winter. High BOD in summer and low in winter is in accordance with the findings [13-14].

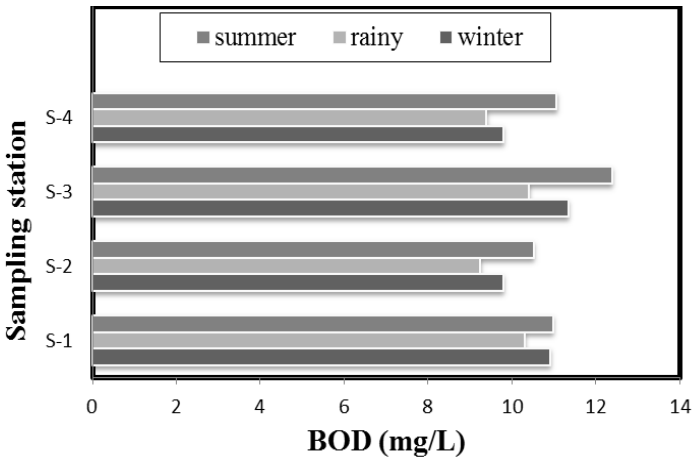

Fig.2.2: Seasonal variations in concentration of Biological Oxygen Demand (BOD) in Solmari River, Khulna, Bangladesh.

Chemical Oxygen Demand (COD):

COD is the measure of pollution in aquatic system. High COD may cause oxygen depletion on account of decomposition of microbes to a level detrimental to aquatic life [15]. It is the amount of oxygen present in the water that is required or used in various chemical reactions (mainly oxidation) occurring in the water. Chemical oxygen demand (COD) is used as a measure of oxygen requirement of a sample that is susceptible to oxidation by strong chemical oxidant. Fig. 2.3 shows that COD was high in summer followed by winter & monsoon. In summer, COD was varied from (12.41-14.71) mg/L with maximum at S-3(14.71 mg/L). In rainy season, COD varied from (10.38-11.66) mg/L with maximum at S-3(11.66mg/L) and in winter, COD was varied from (10.69-12.52) mg/L with maximum at S-3 (12.52 mg/L). The high value of COD encountered in all of our selected study sites of Solmari river, above the permissible limit of WHO (10 ppm), indicates the pollution by degradable organic wastes from various sources. Data has shown significant variations ($p<0.005$) among various seasons.

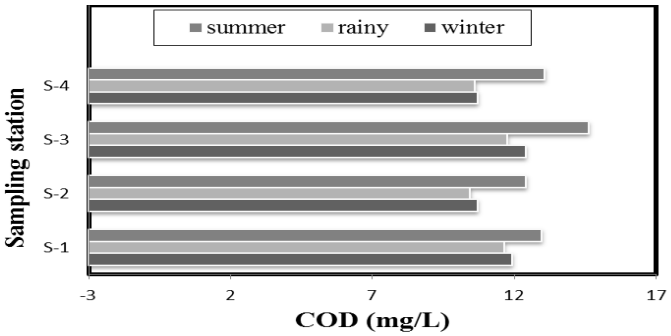

Fig.2.3: Seasonal variations in concentration of Chemical Oxygen Demand (COD) in Solmari River, Khulna, Bangladesh.

IV. CONCLUSION

From the analysis, it can be conclude that decreased dissolved oxygen & elevated levels of BOD and COD have shown organic matter presence in Solmari River that might carry disastrous effects on aquatic life & human health. Though DO was found to be in permissible limits at all the study sites among various seasons but elevated levels of BOD & COD is worrisome. BOD has shown significant variations ($p<0.005$) between summer & monsoon and summer & winter. The high value of COD encountered in all of our selected study sites of Solmari River, above the permissible limit of WHO (10 ppm), indicates the pollution by degradable organic wastes from various sources.

REFERENCES

[1] Kumar, G.N. P.;Srinivas, p.; Chandra, G.K.;Sujatha, P.International Journal of Water Resources and Environmental Engineering, **2010**, 2, 70-78.
[2] Karr, J.Rivers as Sentinels: Using the Biology of Rivers to Guide Landscape Management, In River Ecology and Management: Lessons from the Pacific Coastal Eco-region, ed. Naiman RJ and Bilby RE, New York: Springer-Verlag, **1998**, 502-528.
[3] Jackher, G. R.; Rawat, M.Studies on physicochemical parameters of a tropical lake, Jodpur, Rajasthan, India,Journal of Aquaculture Biology, **2004**, 18, 79-83.
[4] APHA, Standard Method for the Examination of water and Waste Water, (14th edition), American public Health Association, New York, **1992**.
[5] Trivedi, R.K.;Goel, P. K.Chemical and biological methods for water pollution studies, Environmental Publications Karad, India, **1984**, 250.
[6] Bhatnagar, A.;Singh, G. Culture fisheries in village ponds: a multi-location study in Haryana, India. Agriculture and Biology Journal of North America, **2010**, vol. 1, pp. 961-968.
[7] Michaud, J. P.A citizen's guide to understanding and monitoring lakes and streams, Washington State Department of Ecology, Publication No. 94-149, Publications Office, Olympia, WA, USA, **1991**, 407-7472.
[8] Mandal, P.;Upadhyay, R.; Hasan, A. Seasonal and spatial variation of Yamuna River water quality in Delhi, India. Environmental Monitoring and Assessment, **2010**, 170, 661–670.
[9] Kaur, S.; Singh, I.Comparative physico-chemical analysis of Yamuna river, Delhi, at Okhla Barrage in Premonsoon and post-monsoon season. International Journal of Research in Science and Technology, **2011**, 1, 2249-0604.
[10] Kaur, S.; Singh, I. Quality evaluation of Yamuna water at Wazirabad and Okhla in Delhi region in summer, winter and monsoon season, Global J. of Mod. Biol. & Tech. **2012**, 2, 20-22.
[11] Bhanja, K.;Ajoy,M.;Patra, K. U.Studies on the water quality index of River Sanamachhakandanaat KoenjharGarh, Orissa, India.Poll.Res. **2000**, 19, 377-385.
[12] Martin, E.; Hine, R.S. A Dictionary of Biology, Oxford University Press, UK, **2000**.
[13] Das, J.;Acharya, B. C. Hydrology and assessment of lotic water quality in Cuttack city, India. Water, Air and Soil Pollution.**2003**, 150, 163-175.
[14] Maya, K.;Babu, K.N.;Pabdmalal, D.;Seralathan, P. Hydrochemistry and dissolved nutrient flux of two small catchment rivers, south western India. Journal of Chemical Ecology.**2007**, 23, 13-27.
[15] Sivakumar, A. A.; Logasamy, S.;Thirumathal, K.;Aruchami, M. Environmental investigation of river Amaravathi. Env.Conserv.And Manag.**1989**, 85-92.

Md. Nazim Uddin. "Seasonal Variations and Assessment of Oxygen Demanding Parameters (DO, BOD, COD) in Solmari River, Bangladesh." The International Journal of Engineering and Science (IJES), vol. 6, no. 9, 2017, pp. 45–48.