

## Assessing the Effect of Jute Retting on pH and Dissolved Oxygen of River Water: a Case Study on Chitra River, Bangladesh

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**Abstract:** Jute is the main cash crop of Bangladesh. After its cultivation, fibers are usually separated from the stems of jute plants by retting in water. The given study was conducted with an aim to assess the effect of jute retting on the river water pH and dissolved oxygen (DO). This event was studied on Chitra River which is readily used for the retting purpose of jute plants cultivated around the area. Samples were collected from Chitra River both in high tide and low tide during pre jute retting, jute retting and post jute retting period and thereafter analyzed for pH and DO. The estimated results corresponding to the three periods namely pre jute retting, jute retting and post jute retting were compared to evaluate the effect of jute retting on this river water pH and DO. The result revealed that pH and DO of the river water lowers significantly during the jute retting period but this pollution is found as a transitory pollution.

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### I. Introduction

Jute (*Corchorus* sp.) is usually considered as the main cash crop of Bangladesh cultivated almost all over the country and its quality alters depending on the cultivated soil type and as well as its retting process<sup>1</sup>. Jute retting is a biologic process of fiber separation from the stems of jute plant through decomposition process which is carried out by the coupled action of aqua and aquatic microorganisms<sup>2</sup>. For retting purpose lakes, rivers, ponds, roadside canals etc are usually used. During the retting process an extensive amount of biomass decomposes in the water<sup>3</sup> which appears as the waste liquor and scum on the surface of the water<sup>4</sup>. Also the decomposition produces bad smell in water as well as changes the water color<sup>5,6</sup>. Water quality of these sources can alter because of jute retting. Water quality is regarded as a set of variables including physical and chemical parameters (pH, dissolved oxygen, temperature etc.) and any changes in these variables affect aquatic biota in different ways<sup>7</sup>. Chitra River is a coastal river flowing through Narail District of Bangladesh which is widely used for jute retting during the retting period. A case study was carried out on this river to assess effect of jute retting on two significant water quality parameters namely pH and dissolved oxygen (DO) of the river water.

### II. Materials and Methods

#### Study area:

The study was carried out on the Chitra River residing in southwestern part of Bangladesh to address the effect of jute retting on pH and DO of the river water which is used for jute retting. This river originating from the lower part of Chuadanga and Darsana, flows about 170 km in southeast, thereafter attach with Nabaganga River in Gazirhat of Narail district, Bangladesh.

#### Sampling:

Water samples were collected two times in each of pre jute retting period in the month of April and May, jute retting period in the month of July and August and post jute retting period in the month of October and November from the five selected stations of the Chitra River both in high tide and low tide. Coordinates of the spots were measured by a GPS device.

Table 1. Introduction of the sampling stations

Station No.	Sample ID	Co-ordinates	
		Longitude (E)	Latitude (N)
S1	S1HT, S1LT	89° 31' 4.98"	23° 14' 15.11"
S2	S2HT, S2LT	89° 30' 51.37"	23° 11' 50.97"
S3	S3HT, S3LT	89° 30' 48.95"	23° 10' 8.75"
S4	S4HT, S4LT	89° 31' 35.2"	23° 8' 34.8"
S5	S5HT, S5LT	89° 29' 51.53"	23° 6' 30.62"

Note: HT = High tide, LT = Low tide

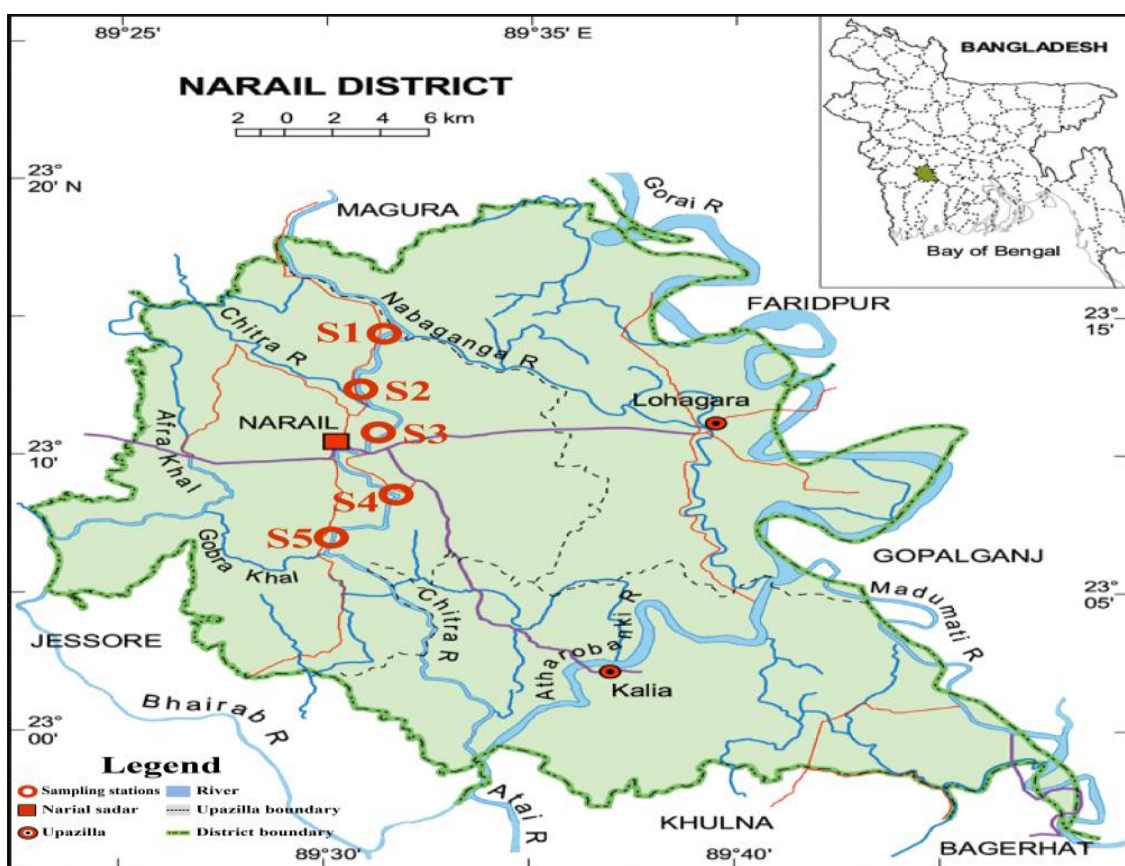


Figure 1. Map of the sampling stations along the Chitra River<sup>8</sup>

**Sample analysis:**

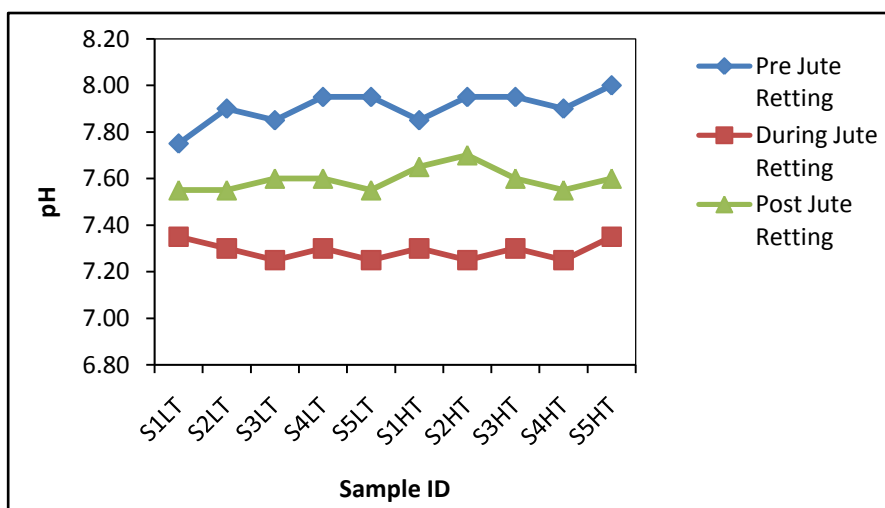
Within the study, pH of the water samples were measured in situ using a pH meter (Model No. pH-5011). DO was also measured in situ by Winkler’s method following the guidelines of standard procedure<sup>9</sup>.

**III. Results and Discussions**

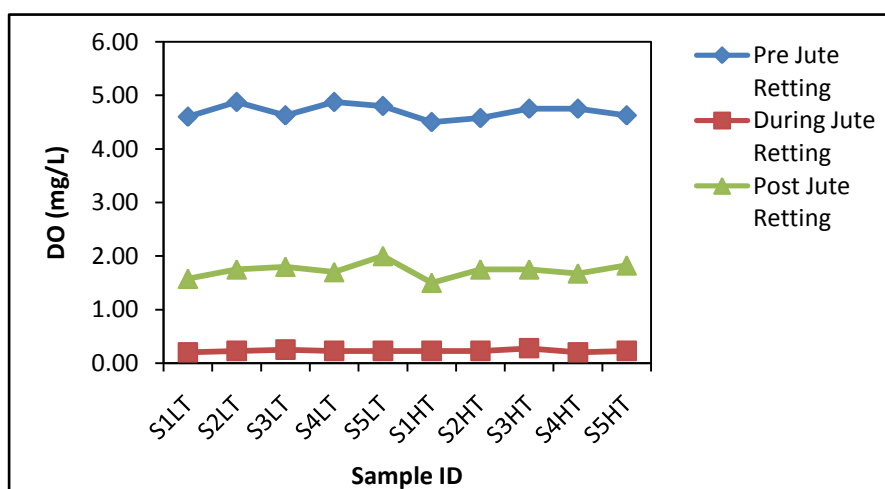
The results obtained under the study are organized in Table 2 which shows a significant variation in both of pH and DO value among the three representative sampling periods namely pre jute retting, jute retting and post jute retting. pH was varied between 7.7 to 8.1 during pre jute retting period, 7.2 to 7.4 during jute retting period and 7.5 to 7.7 during post jute retting period. Although pH was always falling on the alkaline side (7.2 to 8.1), comparatively lower pH was found during jute retting period comparing to another two sampling periods (pre jute retting and post jute retting). This may be because of decomposition process during jute retting when various organic acids diffuse and get mixed with retting water from the jute plant and finally lowers the water pH<sup>6</sup>. The value of Dissolved Oxygen (DO) was varied between 4.25 mg/L to 5.00 mg/L during pre jute retting, 0.15 mg/L to 0.35 mg/L during jute retting and 1.00 mg/L to 2.75 mg/L during post jute retting period. In case of DO, a destructive value reduction is noticed during the jute retting period. The lowering of DO during retting period can be due to jute retting on Chitra River. Because too many microorganism likely bacteria grow during the degradation process which demand an enhanced amount of biochemical oxygen and lowers the water DO destructively during the retting period<sup>6</sup>. The lower DO imposes immediate threat of pollution during jute retting period. So it may be mentioned that, jute retting in any river significantly contribute to the lowering of the corresponding river water pH and DO. But after the completion of retting these negative effects disappear within some days and the value of pH and DO again increases gradually. Therefore the river water pollution caused by jute retting could be described as transitory pollution.

**Table 2.** pH and DO values of the Chitra River during pre jute retting, jute retting and post jute retting period

Parameter	Unit	Sample ID	Duration								
			Pre Jute Retting			Jute Retting			Post Jute Retting		
			April	May	Mean	July	August	Mean	October	November	Mean
pH	-	S1LT	7.70	7.80	7.75	7.40	7.30	7.35	7.50	7.60	7.55
		S2LT	7.80	8.00	7.90	7.30	7.30	7.30	7.50	7.60	7.55
		S3LT	7.80	7.90	7.85	7.30	7.20	7.25	7.60	7.60	7.60
		S4LT	7.90	8.00	7.95	7.30	7.30	7.30	7.50	7.70	7.60
		S5LT	7.90	8.00	7.95	7.30	7.20	7.25	7.50	7.60	7.55
		S1HT	7.80	7.90	7.85	7.30	7.30	7.30	7.60	7.70	7.65
		S2HT	7.80	8.10	7.95	7.30	7.20	7.25	7.70	7.70	7.70
		S3HT	7.90	8.00	7.95	7.40	7.20	7.30	7.50	7.70	7.60
		S4HT	7.90	7.90	7.90	7.30	7.20	7.25	7.50	7.60	7.55
		S5HT	7.90	8.10	8.00	7.40	7.30	7.35	7.60	7.60	7.60
DO	mg/L	S1LT	4.50	4.70	4.60	0.25	0.15	0.20	1.00	2.15	1.58
		S2LT	4.75	5.00	4.88	0.25	0.20	0.23	1.15	2.35	1.75
		S3LT	4.50	4.75	4.63	0.35	0.15	0.25	1.35	2.25	1.80
		S4LT	4.75	5.00	4.88	0.30	0.15	0.23	1.15	2.25	1.70
		S5LT	4.60	5.00	4.80	0.30	0.15	0.23	1.25	2.75	2.00
		S1HT	4.25	4.75	4.50	0.25	0.20	0.23	1.00	2.00	1.50
		S2HT	4.50	4.65	4.58	0.25	0.20	0.23	1.25	2.25	1.75
		S3HT	4.50	5.00	4.75	0.30	0.25	0.28	1.25	2.25	1.75
		S4HT	4.75	4.75	4.75	0.25	0.15	0.20	1.35	2.00	1.68
		S5HT	4.50	4.75	4.63	0.30	0.15	0.23	1.30	2.35	1.83



**Figure 2.** Variation of pH along the Chitra River during pre jute retting, jute retting and post jute retting period



**Figure 3.** Variation of DO along the Chitra River during pre jute retting, jute retting and post jute retting period

#### **IV. Conclusion**

The findings of the study carried on Chitra River reveals that the pH and DO decreases significantly during the jute retting period. pH of this river water was varied between 7.7 to 8.1, 7.2 to 7.4 and 7.5 to 7.7 during pre jute retting, jute retting and post jute retting period respectively. And DO value was also varied between 4.25 mg/L to 5.00 mg/L, 0.15 mg/L to 0.35 mg/L and 1.00 mg/L to 2.75 mg/L during pre jute retting, jute retting and post jute retting period respectively. Since jute retting process alters the river water pH and DO significantly, a detailed investigation concerning the effect of jute retting on the others water quality parameters should be conducted before using it in different purpose. And also suitable, easy and immediate treatment procedures of this polluted water should be found out.

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#### **References**

- [1]. Uddin MJ, Hossain J, Hoque MA. Present condition of jute sector in Bangladesh. *Banglavisian Research Journal*. 2014; 14(1):68-79.
- [2]. Ali MR, Kozan O, Rahman A, Islam KT, Hossain MI. Jute retting process: present practice and problems in Bangladesh. *Agricultural Engineering International CIGR Journal*. 2015; 17(2): 243-247.
- [3]. Banik A, Sen M, Sen SP. Methane emission from jute-retting tanks. *Ecological Engineering*. 1993; 2(1):73-79.
- [4]. Banerjee S, Dastidar MG. Use of jute processing wastes for treatment of wastewater contaminated with dye and other organics. *Bioresource Technology*. 2005; 96 (17): 1919-1928.
- [5]. Ahmed Z, Akhter F. Jute retting: an overview. *Online Journal of Biological Science*. 2001; 1(7):685–688.
- [6]. Roy S, Hassan KM. Scenario of water pollution by retting of jute and its impact on aquatic lives. *Proceedings of the 3rd international conference on civil engineering for sustainable development (ICCESD 2016)*. ISBN: 978-984-34-0265-3.
- [7]. Adekunle AS, Eniola ITK. Industrial effluents on quality of segment of Asa river within an industrial estate in Ilorin, Nigeria. *New York Science Journal*. 2008; 1(1):17-21.
- [8]. Kundu R, Ara MH. Irrigation water quality assessment of Chitra River, Southwest Bangladesh. *Journal of Geoscience and Environment Protection*. 2019; 7:175-191.
- [9]. Verma RM. *Analytical chemistry*. New Delhi: Satish Kumar Jain for CBS Publishers and Distribution. 1994.

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