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Research paper

Effect of the duration of retting on jute fiber length

Md. Redwanul Islam [1]*, Fahmida-E-Karim [1], Farhana Afroz [2], Sk Nazmus Saaqib [3], Kazi Rezwan Hossain [4]

*[1*4] Lecturer, Department of Textile Engineering, Ahsanullah University of Science and Technology (AUST), Bangladesh*
[1]Lecturer, Department of Textile Engineering, BGMEA University of Fashion and Technology (BUFT), Bangladesh
[2]Assistant Professor, Department of Textile Engineering, BGMEA University of Fashion and Technology (BUFT), Bangladesh
[3]Assistant Professor (Fashion & Design), Pabna Textile Engineering College, Pabna, Bangladesh
**Corresponding author E-mail: redwan.tex@aust.edu*

Abstract

The length of a fiber is very important property. The product which should be manufactured is depends on the perfect length of fiber. There are so many natural long staple fibers. Among them jute fiber plays an important role in Indian-subcontinent because in this climate jute plant grows well and we get good qualities jute fiber. But it a matter of great sorrow that our farmers are illiterate and they have no idea about the time limit of retting. Sometimes jute fibers are rated too much long time around 40 to 50 days and sometimes below 30 days. For this reason different length fibers have got on the duration of retting limit. Here the article is about effect on this retting process and it should be identified that how long retting is suitable for getting good length jute fiber. In this article it is shared about the information of length deviation from between these durations. It's known to us all the fibers are not textile fibers, so for achieving good textile product it's needed to use the proper length of fibers.

Keywords: *Jute; Retting; Cellulose; Lignin; Fiber Length.*

1. Introduction

Jute grows well in rainy season; the time is from March to May according to rainfall and type of land. It is harvested from June to September which depends upon whether the sowings are early or late. Jute needs hot and humid climate with temperature between 24° C to 37° C. Constant rain or water-logging is harmful. The new gray alluvial soil of good depth, receiving salt from annual floods, is best for jute. Flow ever jute grows in sandy loams and clay loams [1]. Retting could be a handle in which the tied bundles of jute stalks are taken to the tank by which strands get extricated and isolated from the woody stalk. The bundles are soaks in water at slightest 60 cm to 100 cm profundity. The retting prepare is completed in 8 to 30 days, when the barks partitioned out effectively from the stick or wood and the filaments are prepared for extraction. Advancement in later a long time is appropriation of lace retting innovation in jute developing exchange of the nation.

Jute retting water in a few zones of Bangladesh is one of the major issues. The most reason of this ponder was given data approximately the status of show jute retting prepare as well as said the preferences and drawbacks of diverse jute retting forms. Information almost conventional jute retting handle and lace retting prepare were collected through individual meet from the jute cultivators. The agriculturists are included in jute development and larger part of them utilizes the conventional strategy and time devouring approach of retting in ponds/canals. The conventional strategy hampers the quality of the jute fiber, angle development and pollutes the environment because it breaks down bio-mass. For minimizing the issues of jute retting handle, the ranchers are presently more interested on lace retting prepare [2]. Retting is a preferential rotting process to separate the fibre from jute stick without damaging the fibre cellulose. Retting micro-organism consume the non-fibrous cementing materials mainly pectin and hemicellulose. Over retting causes damage of fibre cellulose while under retting causes incomplete removal of gummy materials viz., pectic substances. Both over retting and under retting which are very difficult to control causes production of low grade jute fibre. In conventional retting, a huge biomass undergoes decomposition in stagnant water and retting causes environmental pollution. In ribbon retting, ribbons are stripped out mechanically from the stem of mature jute plants, coiled and allowed to ret under water. Ribbon retting reduces time of normal retting by 4–5 days. Moreover, requirement of water for ribbon retting is almost half in comparison to conventional whole plant retting under normal condition. This also reduces environmental pollution to a great extent. But use of efficient pectinolytic microbial inoculum improves quality of fibre, further reduce the time of retting and the environmental pollution [3].

The chemical composition of jute fiber includes cellulose (64.4%), hemicellulose (12%), pectin (0.2%), lignin (11.8%), water soluble (1.1%), wax (0.5%), and water (10%). Jute fiber consists of several cells. Moisture content was found highest (12.6855 %) in bottom part and lowest (8.24 %) in top part. In bottom part, cellulose content was found lowest (58.24 %) and highest was found in the top part. Hemicellulose was found highest (23.73 %) in top part of OM-1 and lowest (16.39 %) in middle part. In case of lignin content, it was observed that 17.98 % was found in bottom part which seems to be highest and lowest (13.61 %) was found in top part. In the top and

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bottom part, ash content was found lowest (0.112 %) and highest (0.995 %) respectively [4]. Jute fibers were chopped to approximately 100 mm in length and then processed through a granulator having an 8-mm screen. Final fiber lengths were up to 10 mm maximum [5]. Recently, the demand for reinforced plastics from natural, sustainable, biodegradable, and environmentally friendly fibers has been rising worldwide. However, the main shortcoming of natural fibers reinforced plastics is the poor compatibility between reinforcing fibers and the matrix. Hence, it is necessary to form a strong attachment of the fibers to the matrix to obtain the optimum performance [6]. During the last few decades, composite materials have gained much attention from researchers in the fields of materials science and engineering materials [7], [8].

2. Materials and methods

2.1. Materials

Raw jute fiber, measuring scale, fiber extractor. Here the samples are given which were got after the retting process.



Fig. 1: Jute Fibers After 5 Days Retting.

From the above figure it is shown that jute fibers are randomly oriented in different direction and the lengths of the fibers are small in size from the general fiber length.



Fig. 2: Jute Fibers After 10 Days Retting.

From the above figure it is shown that jute fibers are slightly randomly oriented in different direction but better than 5 days retting and the length of the fibers are small but slightly larger than 5 days.



Fig. 3: Jute Fibers After 20 Days Retting.

From the above figure it is shown that jute fibers are slightly randomly oriented in different direction but better than 10 days retting, and the length of the fibers are small but slightly larger than 10 days retted fibers.



Fig. 4: Jute Fibers After 30 Days Retting.

From the above figure it is shown that jute fibers are mostly oriented in same direction and the lengths of the fibers are also larger than all other retted fibers.



Fig. 5: Jute Fibers After 40 Days Retting.

From the above figure it is shown that jute fibers are slightly oriented than 30 days retted fibers because after a long time retting process the lignin between ultimate fibers are broken down and fibers are turn into small length.

2.2. Methods

The jute fibers were collected form selected four upazillas (sub-district) of Chandpur Districts. These four Upazillas are Chandpur Sadar, Matlab Dakkhin, Kachua and Hajiganj. Purposive selection was favoured because maximum numbers of jute growers are located in these Upazillas. Moreover, the areas are familiar to the researcher. All jute farmers under these four upzillas were considered as population. To get generalizable data in short time 803 jute growers were sampled following a convenience sampling [9]. These fibers were collected and consider the at a particular duration like 5 days, 10 days, 20 days, 30 days, 40 days. In Bangladesh most of the water used for agricultural work which comes from rivers. Due to the climate change, nowadays there is no sufficient water in rivers so that the farmers are unable to apply retting process in right time. For this reason, farmers delay to harvest or after harvest farmers stag the entire jute crop and wait until for sufficient water. Moreover some of lower areas like as canals, tanks, ponds or ditches water use for retting jute which affect the quality of the jute retting as well as jute fiber quality as it is done in muddy water [10].
A numbers of fibers are collected from different samples which were retted at 5 days, 10 days, 20 days, 30 days and 40 days. Then the fibers are splited and measure the length of fibers. It is shown that length fibers are varies from retting duration. The retting process is the major limitation to an efficient and high quality fibre production, thus being the key feature in any future expansion of this industrial crop. The industrial retting process needs to be enhanced by speeding up and controlling the process to improve fibre quality and reduce production costs [11]. At present, the most promising retting process is the water based microbiological retting [12]. During microbiological retting, depolymerization of pectin is operated by pectinases, primarily comprising of a mixture of four enzymatic activities: PG, PNL, pectate lyase and pectin esterase. However, PG [13] and PNL [14] are the primary retting enzymes. In addition it ensures better quality of jute fibre in terms of fibre strength, fineness, colour, lusture and overall absolutely bark free jute fibre [15].

3. Result and discussion

Table 1: Sampling After 5 Days

No. of sampling	Length (cm)	Average Length	Standard Deviation
1.	3.00 cm	3.23 cm	0.3595
2.	3.50 cm		
3.	3.20 cm		
4.	4.00 cm		
5.	3.15 cm		
6.	2.90 cm		
7.	3.10 cm		
8.	3.00 cm		

From the above table we can see that the average length of jute fiber after 5 days retting is 3.23 cm because of the randomly orientation and improper retting of fibers.

Table 2: Sampling After 10 Days

No. of sampling	Length (cm)	Average Length	Standard Deviation
1.	6.00 cm	6.88 cm	0.4385
2.	6.50 cm		
3.	7.20 cm		
4.	7.00 cm		
5.	7.15 cm		
6.	7.11 cm		
7.	7.30 cm		
8.	6.79 cm		

From the above table we can see that the average length of jute fiber after 10 days retting is 6.88 cm which is slightly better than 5 days retted fibers.

Table 3: Sampling After 20 Days

No. of sampling	Length (cm)	Average Length	Standard Deviation
1.	7.00 cm	7.71 cm	0.4948
2.	7.50 cm		
3.	8.20 cm		
4.	8.00 cm		
5.	7.15 cm		
6.	7.88 cm		
7.	7.56 cm		

8.	8.40 cm

From the above table we can see that the average length of jute fiber after 20 days retting is 7.71 cm which is slightly better than 10 days retted fibers.

Table 4: Sampling After 30 Days

No. of sampling	Length (cm)	Average Length	Standard Deviation
1.	16.00 cm	15.85 cm	1.0025
2.	15.50 cm		
3.	16.20 cm		
4.	15.00 cm		
5.	14.15 cm		
6.	17.00 cm		
7.	17.20 cm		
8.	15.75 cm		

From the above table we can see that the average length of jute fiber after 30 days retting is 15.85 cm, which is better than any 5, 10 and 20 days retted fibers.

Table 5: Sampling After 40 Days

No. of sampling	Length (cm)	Average Length	Standard Deviation
1.	10.00 cm	10.76 cm	0.1937
2.	11.00 cm		
3.	11.10 cm		
4.	10.30 cm		
5.	11.10 cm		
6.	10.89 cm		
7.	11.20 cm		
8.	10.50 cm		

From the above table we can see that the average length of jute fiber after 40 days retting is 10.76 cm which is shorter than 30 days retting because of excess retting.

3.1. Combine result analysis

Table 6: Combine Result Analysis

Retting duration (days)	Average Length (cm)
5	3.23 cm
10	6.88 cm
20	7.71 cm
30	15.85 cm
40	10.76 cm

From the above table we can see 15.85 cm is the higher average length, which we get after 30 days retting.

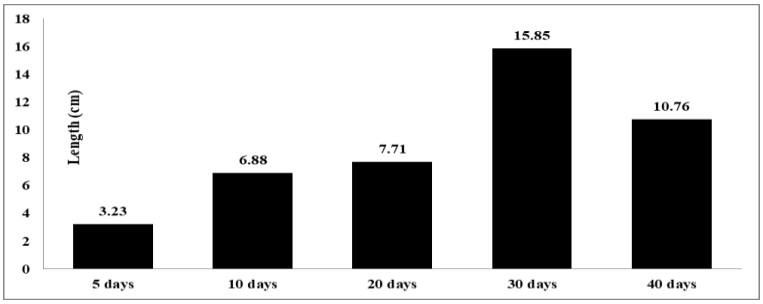


Fig. 6: Combine Result Analytical Graph.

Table 7: Combine Result Analysis of Standard Deviation

Retting duration (days)	Standard Deviation
5	0.3595
10	0.4385
20	0.4948
30	1.0025
40	0.1937

4. Conclusion

It is known to all that the length of textile fibers plays an important role in textile industry. So it is necessary maintain the length of fiber. Jute fibers are extracted after retting. For this reason retting duration is essential to maintain the technical jute fiber length. Jute fibers are not a single fibber. It's the combination of ultimate cell which are 1.5 to 4 millimeters. These ultimate cells are connected by lignin. After the retting process this lignin layers are broken down. At first we need to break down this lignin layer because this layer makes the fiber brittle and hard. For this reason retting process is must for jute fiber but excess retting duration is harmful. Because this excessive retting limit break down the maximum lignin layer, which individual the lignin fibers and jute fibers length become short. From the above it has

been shown that the jute fibers length is varies after duration of retting. The average longer length fiber got after 30 days retting. Maximum or minimum duration of retting both are harmful for jute fibers. Maximum people don't know about this matter that's why factories got different length fibers from a particular land. It's highly required to maintain the raw jute fibers, which we got from the field.

The fiber extraction process has been done manually. That's why some unintentional error has been occurred. Because during manual extraction the tension was not maintained properly. The retting process also depends on the conditions of atmosphere. So, it is necessary to collect the fibers from a particular place.

In future different zonal fibers can be used. The retting process can be done at different zonal area at different atmospheric condition. People who are connected directly to collect these raw materials can be informed and trained them up about the necessity of retting duration.

References

[1] Jute cultivation. (n.d.). Worldjute.Com. Retrieved December 1, 2021, from http://worldjute.com/about_jute/abj_cultivation.html .

[2] Ali, M. R., Kozan, O., Rahman, A., Islam, K. T., & Hossain, M. I. (2015). Jute retting process: present practice and problems in Bangladesh. *Agricultural Engineering International: CIGR Journal*, *17*(2).

[3] Banik, S., Basak, M. K., Paul, D., Nayak, P., Sardar, D., Sil, S. C., ... & Ghosh, A. (2003). Ribbon retting of jute—a prospective and eco-friendly method for improvement of fibre quality. *Industrial Crops and Products*, *17*(3), 183-190. https://doi.org/10.1016/S0926-6690(02)00097-3.

[4] Ahmed, Z., Haque, M. S., Akhter, F., & Begum, M. (2003). Study of the chemical composition of different pipeline varieties of jute fibres. *Pakistan Journal of Biological Sciences (Pakistan)*. https://doi.org/10.3923/pjbs.2003.1463.1467.

[5] Rana, A. K., Mandal, A., Mitra, B. C., Jacobson, R., Rowell, R., & Banerjee, A. N. (1998). Short jute fiber-reinforced polypropylene composites: Effect of compatibilizer. *Journal of Applied Polymer Science*, *69*(2), 329-338. https://doi.org/10.1002/(SICI)1097-4628(19980711)69:2<329::AID-APP14>3.0.CO;2-R.

[6] Wang, H., Memon, H., AM Hassan, E., Miah, M., & Ali, M. (2019). Effect of jute fiber modification on mechanical properties of jute fiber composite. *Materials*, *12*(8), 1226. https://doi.org/10.3390/ma12081226.

[7] Mittal, V., Saini, R., & Sinha, S. (2016). Natural fiber-mediated epoxy composites–a review. *Composites Part B: Engineering*, *99*, 425-435. https://doi.org/10.1016/j.compositesb.2016.06.051.

[8] Hu, Q., Zhang, Y., Mao, Y., Memon, H., Qiu, Y., Wei, Y., & Liu, W. (2019). A comparative study on interlaminar properties of l-shaped two-dimensional (2d) and three-dimensional (3d) woven composites. Applied Composite Materials, 26(3), 723-744. https://doi.org/10.1007/s10443-018-9745-6.

[9] Islam, M. M., Xiaoying, J., Uddin, M. E., & Bhuiyan, F. (2015). Status and constraints of jute cultivation in Bangladesh: an experience from selected upazilas under Chandpur district. *Asian Journal of Agriculture and Rural Development*, *5*(8), 175-186.

[10] M.R.A.O.K.A.R. (2015, June 1). *Jute retting process: Present practice and problems in Bangladesh*. ResearchGate. Retrieved December 5, 2021, from https://www.researchgate.net/publication/279753130_Jute_retting_process_Present_practice_and_problems_in_Bangladesh.

[11] Aarestrup, F. M., Ahrens, P., Madsen, M., Pallesen, L. V., Poulsen, R. L., & Westh, H. (1996). Glycopeptide susceptibility among Danish Enterococcus faecium and Enterococcus faecalis isolates of animal and human origin and PCR identification of genes within the VanA cluster. *Antimicrobial agents and chemotherapy*, *40*(8), 1938-1940. https://doi.org/10.1128/AAC.40.8.1938.

[12] Ceotto, E., & Di Candilo, M. (2010). Shoot cuttings propagation of giant reed (Arundo donax L.) in water and moist soil: The path forward?. *Biomass and Bioenergy*, *34*(11), 1614-1623. https://doi.org/10.1016/j.biombioe.2010.06.002.

[13] Zhang, W. F., He, Y. L., Zhang, M. S., Yin, Z., & Chen, Q. (2000). Raman scattering study on anatase TiO2 nanocrystals. *Journal of Physics D: Applied Physics*, *33*(8), 912. https://doi.org/10.1088/0022-3727/33/8/305.

[14] Soriano, J. B., Visick, G. T., Muellerova, H., Payvandi, N., & Hansell, A. L. (2005). Patterns of comorbidities in newly diagnosed COPD and asthma in primary care. *Chest*, *128*(4), 2099-2107. https://doi.org/10.1378/chest.128.4.2099.

[15] Banik, S. B. A. S. G. S., Bandyopadhyay, S., & Ganguly, S. (2003). Bioeffects of microwave—a brief review. *Bioresource technology*, *87*(2), 155-159. https://doi.org/10.1016/S0960-8524(02)00169-4.