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The Effect of Chemical Treatment on Tensile Strength and Weight of Banana Stem Fiber after Treating with Various Chemicals

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Abstract: *Banana is a very popular fruit due to its low price and is used both as vegetable and as a dessert fruit. Banana plant has pseudo stems which is the major source of a natural fiber. So the purpose of this project has been to investigate the chemical resistance properties and tested against various chemicals with their tensile strength value. The Banana crop shares about 20% of total fruits production with 36% share in area (BBS estimate 2009-10). So, total land of Bangladesh which has been cultivated banana plant for estimated amount of banana fiber can be extracted from those banana plant together with their approximate value annually has been estimated which will be exported to international market to earn foreign currencies. For pursuing this project work "**Saba Banana**" (ABB genome) banana plant was used. In this study, Banana fiber was extracted manually and tested for Tensile and Chemical resistance against various chemicals in Primeasia University testing lab. The result has been recorded and compared against the untreated banana fiber. Only in Phenol and Nitrobenzene, Banana fiber wt. is not effected and in all chemical, the strength has been significantly decreased as well as the fiber weight but in NaOH the weight of the fiber is significantly increased.*

Keyword: *Saba Banana, banana fiber Tensile strength and chemical properties.*

I. Introduction

In the recent years, the synthetic products are dominating over the natural fibers due to the low cost and durability but the synthetic fiber is not biodegradable and most concerning fact is that it pollutes the environment. But now everybody put emphasis on green technology and is seriously concerned about the environment. Natural fibers meet our clothing needs as well as they are eco-friendly. But some natural fibers had been remained unturned for a long time and for this reason proper utilization of natural resources become very important. Natural fibers are environmentally friendly as they provide some important properties like low density, appropriate stiffness, and mechanical properties and high disposability; moreover they are recyclable and degradable. Banana fiber, a ligno-cellulosic fiber, obtained from the pseudo-stem of banana plant (Musa sepientum), is a bast fiber with relatively good mechanical properties. Banana fiber at present is a waste product of banana cultivation and either not properly utilized or partially done so. [1]

In recent years the commercial value of banana fiber has increased and it is used all over the world for multiple purposes from making tea bags and sanitary napkins to Japanese yen notes and car tyres. Banana stem, hitherto considered a complete waste, is now is now being made into banana-fiber cloth which comes in differing weights and thicknesses based on what part of the banana stem the fiber was taken from. The innermost sheaths are where the softest fibers are obtained, and the thicker and sturdier fibers come from the outer sheaths [2]. Recently, research works on banana fibers has been done on the Mechanical Properties, the chemical composition of banana pseudo stem, Properties of banana fiber reinforced composites, Its extraction machineries etc. The research field is new to this sector and there is limited information about banana fiber. In our country, very few researchers are working on banana fiber to make this hugely available to our market. So it is the demand of time to work on this fiber to enrich our textile field.

The main objective of this project work is to Extract Banana fiber, estimate the Tensile & Chemical Strength of this extracted fibers.

The main tasks of this research work:

- Chemical Resistance Evaluation
- Tensile Strength Evaluation

II. Materials & Methods

1.1 Banana Plant

Saba Banana (ABB genome, ***Musa acuminata* × *balbisiana***) is also known as Bichi kola in Bangladesh. [3]

(a) (b)

Figure 1: (a) Banana Plant (b) Pseudo Stem

1.2 Chemical Used

Ethanol (C_2H_6O), Acetic Acid (CH_3COOH), Hydrogen Peroxide (H_2O_2), Acetone (C_3H_6O), Phenol (C_6H_6O), Nitrobenzene ($C_6H_5NO_2$), Formaldehyde (CH_2O), Sulfuric Acid (H_2SO_4), Sodium Hydroxide (NaOH) which are collected from Wet Processing Lab of Primeasia University.

1.3 Machine Used

1.3.1 Universal Tensile Strength Testing M/C

Universal Tensile Strength Testing Machine is suitable for carrying out tensile test on variety of materials such as yarns, fabrics, lea, elastomers, papers, wires, etc. B-Tex Engineering provides you with high quality, accurate and reliable testing machine.

Universal Tensile Testing Machine has been designed in such way that one testing space is suitable for extra-long test sample, having long elongation.Universal Tensile Strength Tester confirms with the following international standards: BS EN ISO 13934, Parts 1&2 ASTM D-5034:1995, ASTM D-5035:1995 [4]

1.4 Extraction of Banana Fiber

The pseudo stem is the part of the banana plant that looks like a trunk. It is formed by the tightly packed overlapping leaf sheaths. Even though the pseudo stem is very fleshy and consists mostly of water, it is quite sturdy and can support a bunch that weighs 50 kg or more. The pseudo stem continues to grow in height as the leaves emerge one after the other and reaches its maximum height when the inflorescence emerges at the top of the plant. [5]. To Collect the Pseudo Stem, first we cut down a banana tree and smoothly removed the stem from the plant.

Extraction Process: There is two extraction process of banana fiber from its pseudo stem. They are-

1. Manual &
2. Automatic

We Extracted banana fiber from its pseudo stem by manual extraction process.

Manual Extraction: Banana fiber is generally extracted through a cumbersome manual process. By using a metal scraper (flat and blunt blade), the pseudo stem sheaths are scraped and the fiber is separated. An individual at work can extract just about 500 gm in this manner; the mechanical process yields 10 times the quantity but with heavy damage to the fiber. [6]

Extraction Technique: The Banana tree was cut from one ft. upper from the root by a Chopper knife. Then stems of the plant was separated and stored in a shadow place for retting. Then hammered the stem gently to remove excess waste. Then the impurities are removed by chopper. Finally separate the fiber by combing and the obtained fiber was then cleaned by washing with water and dried the fiber in shadow place.

III. Chemical Treatment of Banana Fiber

The following procedure was adopted in ensuring that the data recorded from tensile test specimens was taken in an organized and consistent manner.

Ethanol (C_2H_6O)

100 ml of Ethanol was taken on a beaker and 40 banana fiber (0.31 gm) is immersed for 30 minutes.

Acetic Acid (CH_3COOH)

100 ml of Acetic Acid was taken on a beaker and 42 banana fiber (0.32 gm) is immersed for 30 minutes.

Hydrogen Peroxide (H_2O_2)

100 ml of Hydrogen Peroxide was taken on a beaker and 42 banana fiber (0.32 gm) is immersed for 30 minutes.

Acetone (C_3H_6O)

100 ml of Acetone (C_3H_6O) was taken on a beaker and 51 banana fiber (0.39 gm) is immersed for 30 minutes.

Phenol (C_6H_6O)

100 ml of Phenol (C_6H_6O) was taken on a beaker and 26 banana fiber (0.20 gm) is immersed for 30 minutes.

Nitrobenzene ($C_6H_5NO_2$)

100 ml of Nitrobenzene ($C_6H_5NO_2$) was taken on a beaker and 38 banana fiber (0.29 gm) is immersed for 30 minutes

Sulfuric Acid (H_2SO_4)

100 ml of 70% Sulfuric Acid (H_2SO_4) was taken on a beaker and 61 banana fiber (0.47 gm) is immersed for 10 minutes

Sodium Hydroxide (NaOH)

100 ml of 20% Sodium Hydroxide (NaOH)was taken on a beaker and 34 banana fiber (0.26 gm) is immersed for 30 minutes

IV. Results and Discussions

4.1 Result of Tensile Strength Tester

Initial Strength of 30 cm long banana fiber (106) : 15.2 kg
So, one banana fiber strength (Avg.) : 0.143 kg
Weight of that fiber bundle : 0.82 gm
Weight of one banana fiber (Avg.) : 0.00775 gm

4.2 Result of Chemical Treatment

Chemical Name	No. of fiber	Wt. (gm) before treatment	Wt. (gm) after treatment	Strength before treatment	Strength after treatment
Ethanol (C_2H_6O)	**40**	0.31 gm	0.28 gm	(40×0.143) = 5.72 kg	3.9 kg
Acetic Acid (CH_3COOH)	**42**	0.32 gm	0.29 gm	(42×0.143) = 6.006 kg	2.2 kg
Hydrogen Peroxide (H_2O_2)	**42**	0.32 gm	0.27 gm	(40×0.143) = 5.72 kg	4.6 kg
Acetone (C_3H_6O	**51**	0.39 gm	0.39 gm	(51×0.143) = 7.293 kg	3.3 kg
Phenol (C_6H_6O)	**26**	0.20 gm	0.20 gm	(20×0.143) = 3.718 kg	1.3 kg
Nitrobenzene ($C_6H_5NO_2$)	**38**	0.29 gm	0.30 gm	(38×0.143) = 5.434 kg	1.6 kg
Formaldehyde (CH_2O)	**40**	0.31 gm	0.26 gm	(40×0.143) = 5.72 kg	2.4 kg
5% Sulfuric Acid (H_2SO_4)	**28**	0.21 gm	0.16 mg	(28×0.143) = 4.004 kg	1.3 kg
20% Sulfuric Acid (H_2SO_4)	**36**	0.28 gm	0.19 gm	(36×0.143) = 5.148 kg	0.9 kg
70% Sulfuric Acid (H_2SO_4)	**61**	0.47 gm	0.00 gm	(61×0.143) = 8.723 kg	0.0 kg
20% Sodium Hydroxide (NaOH)	**34**	0.26 gm	0.46 gm	(34×0.143) = 4.862 kg	1.1 kg
50% Sodium Hydroxide (NaOH)	**36**	0.27 gm	0.38 gm	(36×0.143) = 5.148 kg	0.9 kg

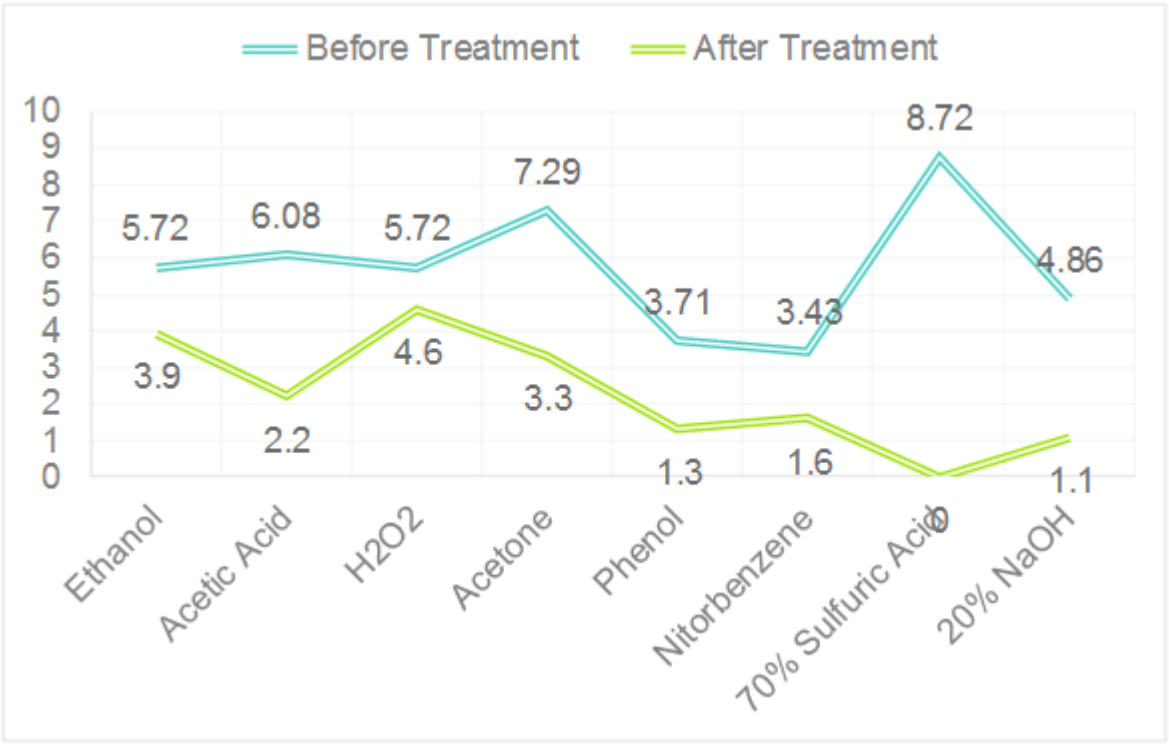

Figure 2: Tensile Strength Test Results (in "kg")

The Tensile Strength is always decreasing against those Chemicals. For Hydrogen Peroxide (H_2O_2), Phenol (C_6H_6O), Nitrobenzene ($C_6H_5NO_2$), the Tensile strength are slightly decreasing and In Sulfuric Acid (H_2SO_4), Fibers Tensile Strength destroyed and tends to dissolve in.

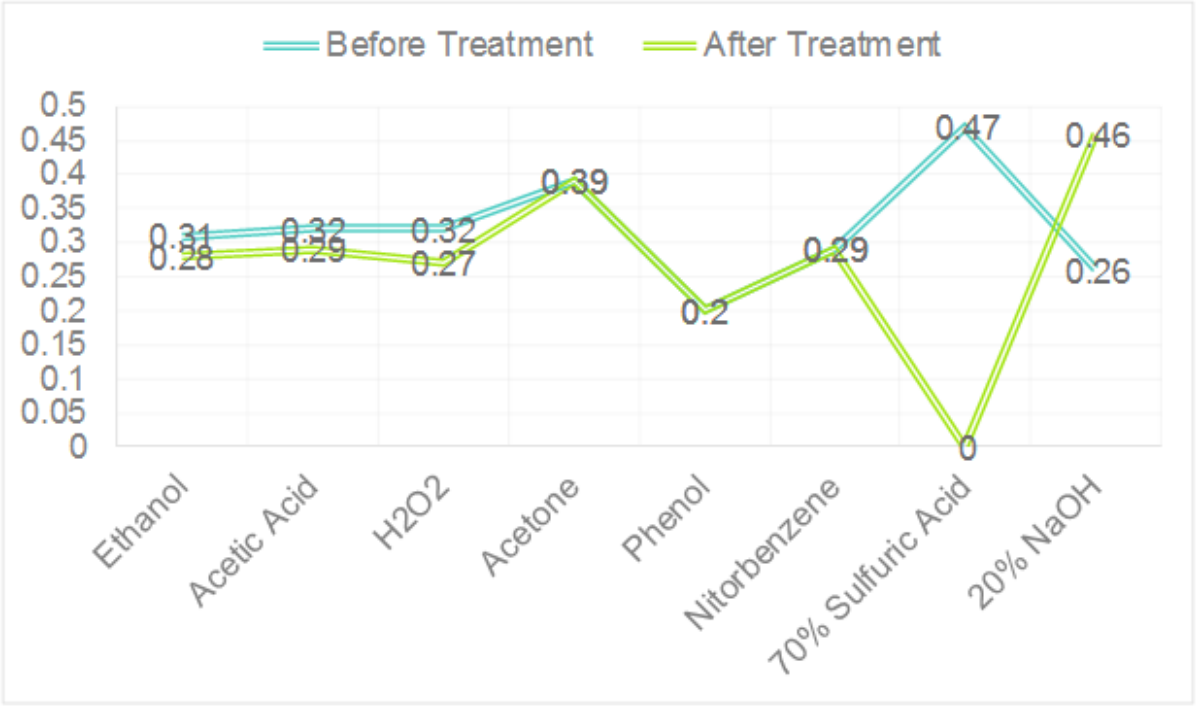

Figure 3: Chemical Resistance Test Results

For Acetone (C_3H_6O), Phenol (C_6H_6O), Nitrobenzene ($C_6H_5NO_2$), the Weight remains same. In Sulfuric Acid (H_2SO_4), Fibers wt. destroyed and tends to dissolve in and in NaOH, wt. of fiber increased.

V. Conclusion

In this study the Tensile Strength and Chemical Resistance of banana fiber against different chemicals is determined. And the result shows that in most of the cases the tensile strength of banana fiber is decreased for treating with chemicals especially in Sulfuric Acid (70% H_2SO_4) the fiber is totally dissolved that is the tensile strength is destroyed. And for some chemicals like Acetone (C_3H_6O), Phenol (C_6H_6O), Nitrobenzene ($C_6H_5NO_2$), the weight of fiber remains almost same that is the weight of the fiber is not affected by those chemicals treatment but In Sulfuric Acid (H_2SO_4), Fibers is destroyed that is the weight of fiber found zero and tends to dissolve in and in NaOH, fiber weight is increased.

References

[1] Hossain, M. B., & Begum, H. Investigation of Spinnability of Banana Fibers through Yarn Formation Along with Analysis of Yarn Properties.
[2] http://www.fiber2fashion.com/industry-article/7654/banana-fiber-a-revolution-in-textiles?page=1
[3] Journal of Reinforced Plastics and Composites. Vol. 33(18); 2014; p.1717-1732
[4] http://www.texcaregroup.com/tensile-testing-equipment-1700600.html\s
[5] http://www.promusa.org/Banana+pseudostem
[6] http://www.thehindu.com/todays-paper/tp-national/tp-kerala/easy-way-to-extract-bananafiber/article3618460. ece

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