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ASSESSMENT OF PHYSICAL PROPERTIES OF BANANA FIBER AFTER ALKALI TREATMENT (SCOURING)

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Abstract

Now a day's people want sustainability in their lives so the demand of natural fibers is growing day by day. People also like the traditional method of construction of fabric and back to organic production methods. The main reason is environmental costs in the production of synthetic fibers. The utilization of plants and trees in fabric formation is increasing day by day. This research was to make banana fiber spinnable and able to blend with cotton. Banana is a coarse fiber and a lot of impurities are there. So it is needed to remove its impurities. Further banana fiber was scoured with 2% & 5% of NaOH, by doing so it got softened. Moisture regain percent age increased and linear density and tensile strength decreased. And the texture of the fiber also get softened.

Introduction

Natural fiber is obtained from plant, animal and mineral sources. Those from plant sources include cotton, flax, hemp, sisal, jute, kenaf, banana, etc. Cellulose is the main component of vegetable fibers, several of which are used in manufacturing of paper and cloth. The most used natural fiber is cotton and flax, although banana is also used. Natural fibers have definite advantages like biodegradability, recyclable, decomposability, low density, and renewability. In terms of usage, there are two general classifications of plants producing natural fibers, primary and secondary. The primary plants are those grown for their fiber contents like cotton jute hemp etc. while secondary plants where the fiber comes as a byproduct from some other prior usage

like pineapple, banana, coconut cereals, palm etc., vegetable fibers are obtained from plants mainly made up of cellulose, hemicelluloses, lignin, pectin and some other waxy substances.

Banana fiber, which is also known as Musa fiber consists a thick wall of cell tissue, bonded together by natural gum and is mainly composed of cellulose, hemicelluloses and lignin. The spin ability, fineness, and tensile strength of Banana fiber are said to be better than other stem cell fibers. Banana is a famous fruit crop belonging to Musaceae family. It is an enormous crop with the pure fortuitous root system. Not only their fruit but its flower and psuedostem are used as a cheap source of vegetable. Even now banana fiber is seen as a sustainable alternative to cotton and silk. Banana fiber is biodegradable and there is no negative effect to the environment. It can be spun through almost all methods of spinning like open end spinning, ring spinning and bast fiber spinning etc.

Some properties of Banana fiber are shown below:

Dia (μm)	80-250
Length (mm)	1000-5000
Moisture content (%)	60
Tensile strength (MPa)	392-677
Cellulose (%)	60-65
Hemi cellulose (%)	6-19
Lignin (%)	5-10
Pectin (%)	3-5

From the above view, the present study was undertaken to analyse the scouring effect in various ratio of NaOH on physical properties of banana fiber to remove their impurities and enhance their spinnabilty.

Objective

1. To scoure the banana fiber on various ratios of NaOH.
2. To check the scouring effect on the properties of banana fiber.

Method and Material

Obtaining of Fiber

Grand Nain (G9) variety fiber are obtained from banana psuedostem which are cultivars of Musa acuminate. It is one of the most cultivated and exported bananas. The obtained fiber are 110-150 cm. long.

Scouring

50 gm of fiber was soaked for preparing two solutions of NaOH (2% and 5%), 3% of Na_2CO_3, 1% wetting agent heated at 100°C for 60 min. Then the materials were washed with overflowing tap water and then drying at room temperature.

M:L Ratio:	1:50
NaOH:	2 and 5 gpl
Na_2CO_3 :	3gpl
Wetting agent:	1gpl
Time:	60 min.
Temperature:	100°C

Nutrilization

The treated fibers were soaked in 5gpl of Acetic acid in 1:50 M:L Ratio and washed it thoroughly and dried.

Finishing: (softening)	
M:L Ratio:	1:50
Softener:	60 gpl
pH:	5
Time:	30 minutes

JBLJ Silicon softener was used for softening of the fiber. pH was balanced with help of Acetic Acid. Mixed the softener well then soaked the fiber for 30 minutes at room temperature.

Tensile strength

The tensile property in terms of single strength fiber, bundle strength and percentage of breaking and extension. Bundle strength tester and Fafegraph – M ASTM D: 3822 were used for testing. 20 cm fiber samples were prepared for strength test. Ten samples were prepared.

Moisture Regain

Using air heated 110°C Oven drying process was acquired to check moisture regain. The samples were weighted two times first in condition state (W^1) and second oven dry state (W^2). Following formula was used to calculate moisture regain.

$$\text{Moisture Regain \%} = \frac{W^1 - W^2}{W^2} \times 100$$

Linear Density

ASTM D: 1577 standard was used to measure Linear Density of the fiber. Average weight of 10 samples of 100 cm. of the fiber was taken for determine denier. Following formula was used to determine the denier of fiber sample.

$$\text{Denier} = \frac{9000 \times W}{L \times N}$$

Where: W = Weight of the cut samples.

L = Length of the fiber samples

N = Number of fibers

Result and Discussion

Mechanical properties of banana fiber before and after alkali treatment (scouring) are explained in the following table:

S.No.	*Condition of fiber*	*Moisture Regain %*	*Tensile strength*			*Linear Density (den)*
			Bundle Strength gm/tex	*Single fiber strength*		
				Breaking strength gf	*Breaking Extension %*	
1.	Untreated	10.54	40.54	503.35	9.94	109.74
2.	2% NaOH Treated	11.45	38.53	465.55	5.68	74.36
3.	5% NaOH Treated	12.23	36.88	402.62	3.68	53.32

1. **Moisture Regain:** After removing wax and pectin substances, moisture regain properties increased. The percent of moisture regain of untreated banana fiber was 10.45%, after scouring with 2% NaOH was 11.45% and with 5% of NaOH was 12.23%.
2. **Tensile Strength:** Banana fiber is stronger than other stem cell fibers. Its strength decreased after treating with NaOH.
   a) **Bundle Strength:** Bundle strength decreased due to loss of lignin, wax and pectin from banana fiber. The bundle strength of untreated Banana fiber was 40.54 gm/tex, treated with 2% NaOH strength was 38.53gm/tex and with 5% NaOH strength was 36.88gm/tex.
   b) **Single Fiber Strength Test:** Single fiber strength also decreased. The untreated banana single fiber strength was 503.35gf and breaking extension percent age was 9.94%, 2% scoured fiber

A)

B)

C)

A) Untreated fiber B) 2% NaOH Scoured fiber C) 5% NaOH Scoured fiber

breaking strength was 465.55 gf and breaking extension percent age was 5.68% and 5% NaOH scoured fiber breaking strength was 402.62gf and breaking extension percent age was 3.68%.

3. **Linear Density:** The density of the fiber also decreased due to removing pectin, wax and lignin. Denier of untreated banana fiber was 109.74 den, 2% NaOH treated fiber was 74.36 den and 5% NaOH treated fiber was 53.32 den.

Conclusion

Now a days people are focusing towards nature. The utilization of plants and trees in fabric formation is increasing because variation is

needed in fabric properties also. The banana plant is very useful plant. Its every part can be used. It does not harm to the environment so it is classified as ecofriendly fiber. Banana is similar to bamboo fiber, but its spinnability and fineness is better. It can be spun by almost every method of spinning, but softening is needed for blending and spinning.

In the present study Banana fiber was scoured with (2% and 5%) NaOH and then softened. The moisture regain percent age increased after scouring, but the tensile strength and linear density of the fiber decreased because of lignin, wax and pectin removal. Hence the properties of Banana fiber improved and also enhanced its spinnability.

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