The Effect of Blending a Ratio of Chorisia Fibers with Weft Yarns on Some Properties of the Fabrics after Bleaching

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ABSTRACT
This study is interested in the effect of Chorisia fibers blended with cotton and polyester wastes on some properties of fabrics produced by comparing the results of those properties of two sets of samples of fabrics, one containing a ratio of Chorisia fibers using wefts 6/1, 13/1 and 17/1 previously produced with 40% Chorisia fibers, 30% cotton wastes and 30% polyester wastes. And the other set was produced with 70% cotton wastes and 30% polyester wastes. To produce fabric samples, cotton warp 100%, count warp 14/1, 58 warps/inch, 40 picks/inch and weaving structure plain 1/1 for both sets of fabrics. Fabrics underwent a scouring and bleaching process using alkaline solution to remove all non-cellulose substance and some tests on samples of fabrics were conducted, namely, tearing strength, ring wear, absorption time and pilling degree. The results were all positive as the set of fabrics containing Chorisia recorded higher values in terms of tearing in weft direction and ring wear of fabrics and improved absorption. All the fabric samples in the two sets were the same concerning pilling value at the same conditions of fabric production and tests which confirmed that a ratio of Chorisia fibers really affected some properties of fabrics produced which is a positive impact that can used in factories of yarn spinning, weaving, knitting and non-woven fabrics.

Keywords--- Bleaching, Chorisia fibers, Cotton wastes, Fabric properties, Polyester wastes

I. INTRODUCTION
Chorisia tree (floss silk tree) is one of the hollow fibers and natural cellulose it has large lumen and thin wall [1-3]. Chorisia fiber is an agricultural product obtained from the fruits of the chorisia tree as kapok and bombax[4-5]. Some researches carried out tests on the physical and the chemical properties of some parts of kapok and bombax. The hollow fibers were used to produce blended yarns [3,6-7], knitting, [8-10], weaving [11-13] and nonwoven fabrics [14-15]. Many of the research focus on the production of blended fabrics of the hollow fibers with its variety of uses. A research study the heat transfer process through kapok/cotton, and pure cotton insulating fabrics at different temperatures against wind speed and compare the heat balance flow of the kapok fabric with the cotton fabric, it can be got that the kapok insulating material can prevent more heat losses from human body than those of the cotton insulating material [16]. Another research studied the difference in wearability of kapok/cotton, pure cotton fabrics then testing some properties for the plain and satin weave at the same count, the testing results showed that some properties of the kapok/cotton fabric were better than that of the pure cotton fabric such as air permeability [11], warmth retention[11-12] and drapability[11] In other study kapok was blended with viscose/PES, kapok/viscose/PES/silver, viscose/PES without kapok to produce fabrics, then comparing the test result of some of their properties, it was found that the fabric that contains kapok improved the warmth retention, crease recovery and anti-ultraviolet radiation, whereas the drapability, air permeability and abrasive resistance go to the bad, while the fabric that contains kapok and silver improved the wettability, warmth retention, anti-ultraviolet radiation, static properties, the abrasive resistance improved, also the crease recovery improved in the weftwise, while the drapability and the air permeability go to the bad [12]. In a study blended yarns count 18.5 and 14.8 tex were produced from blended fibers cotton/kapok of ratio 80/20 then a knitted fabrics were produced using the plain stitches after that these fabrics were undergone to dyeing and softening and from the results of this study it was found that the cotton/kapok fabric is better for the underwear than the cotton/modal because it has a good thermal resistance [10]. The hollow fibers kapok and silk- floss have oil sorption capacity [14,17-18] A study blended polypropylene (pp) /kapok with different ratios 100/0, 75/25, 50/50, 25/75. 10/90 to produce nonwoven fabric prepared by needle punching process to know the effect of these blends on the oil sorption capacity, it was found that blend pp/kapok 50/50 recorded the highest oil sorption capacity because that the ratio has the highest pour volume, the pp/kapok 50/50 has higher oil sorption capacity than the pp.
commercial [14] A study used the kapok/polypropylene blend with ratios 30/70, 40/60 and 50/50 to measure the sound absorption of frequency range 250 – 2000 Hz, these blends were produced as webs which are thermally bonded using the hot air oven to produce two samples: the uncompressed and the compressed one, the results showed that the uncompressed kapok/polypropylene blend of ratio 30/70 has the maximum sound absorption at any given frequency between 250-2000Hz and above the frequency range [15] The aim of this study is using a different kind of the hollow fibres and it maybe unused before it is the chorisia fibres to produce weave fabrics from yarns which are produced previously in a previous study [3] these yarns were used as wefts to the weave fabrics and some of these yarns contain a ratio of chorisia fibers and the others don not contain chorisia fibers at the same count to know the effect of the chorisia fibers ratio in the blend of some properties after scouring and bleaching,

II. EXPERIMENTAL

2-1 Materials:
Chorisia. Fiber was used and blended with cotton and polyester wastes to produce wefts yarns using Open-end spinning
2-2 Preparation of fabrics samples:
The blended weft has been used by ratios 40% chorisia, 30% cotton wastes and 30% polyester wastes. Three wefts counts were used 6/1, 13/1, 17/1 Ne to Produce fabrics. warp yarns is 100% cotton and weaving structure plain 1/1

2-2-1 The specifications of fabrics:
Six fabrics samples were produced and their specifications as shown in table 1

<table>
<thead>
<tr>
<th>No</th>
<th>weft material</th>
<th>Weft blending ratio</th>
<th>Weft count</th>
<th>Weft Twist/inch</th>
<th>Picks/ inch</th>
<th>Warp count</th>
<th>Warps/ inch</th>
<th>Weaving Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cotton wastes</td>
<td>70% Cotton</td>
<td>6/1</td>
<td>14</td>
<td>40</td>
<td>14/1</td>
<td>58</td>
<td>plain 1/1</td>
</tr>
<tr>
<td>2</td>
<td>Polyester wastes</td>
<td>30% Polyester</td>
<td>13/1</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>chorisia</td>
<td>30% chorisia</td>
<td>17/1</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cotton wastes</td>
<td>30% Cotton</td>
<td>6/1</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Polyester wastes</td>
<td>30% Polyester</td>
<td>13/1</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Polyester wastes</td>
<td>30% Polyester</td>
<td>17/1</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2-2-2 The specifications of weaving machine:
Samples of fabrics were produced by the Dobby machine and the machine specifications were as follows:
Kind of machine Inflexible rapier –dobby Belgium
Number of healds 15 healds
Number of used healds 12 healds to fabric +2 healds to selvage
Reeding 2 end / dent
Reed count 27.4 dent / inch
Machine width 250 cm
Fabric width with selvage 186 cm
Machine speed 400 picks / min

2-3 Scouring and bleaching of fabrics samples
The fabric samples were boiled in NaOH solution by a concentration 10 g/L, NH₄HSO₄ solution by a concentration (3 g/L) and silicon solution by a concentration (1 g/L) with continuous stirring for an hour at temperature 95°C.

In the bleaching process H₂O₂ was used 6 cm/L and NaSiO₃ (2 g/L) with continuous stirring for half hour at temperature 90°C, after that the fabrics were washed by cold water then hot water after that the acetic acid solution was added by a concentration (1 g/L) at a temperature 50°C for 10 minutes, finally washed by cold water after that the starch was tested using iodine, all the fabric samples were free of starch

2-4 Fabrics Testing:
Laboratory tests on the produced samples were carried out at the standard conditions for textiles with an air temperature (20± 2°C) and relative humidity of air (65± 5%) according to the American Association of Textile Chemists and Colorists (AATCC)

2-4-1 Tearing strength kg of fabrics samples:
A sample of 6 x 10 cm was taken and the tearing was measured in the direction of weft by using Elmendorf Tearing tester

2-4-2 Ring wear of fabrics samples
The ring wear was measured by count the number of turns by using Ring wear testing.

2-4-3 Absorption time/sec of fabrics samples:
The time of water absorption by samples was measured manually using the stop watch and the
diameter of the sample was 5 cm.

2-4-4 Pilling of fabrics samples:
A sample of 12 × 12 cm was put in the Random tumble pilling tester for an hour then evaluate the pilling appearance

2-4-5 Weight g /m² for the fabrics:
A sample of 10 × 10 cm was weight by using digital balance Sartorius TE 212

III. RESULTS AND DISCUSSION:

After testing the fabric samples changes were noted where the properties of the fabric containing chorisia were improved as shown in table 2 and figs. 1 – 4

<table>
<thead>
<tr>
<th>No</th>
<th>Weft blending ratio</th>
<th>Weft Count Ne</th>
<th>Weft twist /inch</th>
<th>Tearing strength Kg/f</th>
<th>Ring wear /turn</th>
<th>Absorption Time / sec</th>
<th>Pillin g degree</th>
<th>Weight g/ m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70%Cotton wastes</td>
<td>6/1</td>
<td>14</td>
<td>58</td>
<td>7567</td>
<td>10</td>
<td>3/5</td>
<td>299</td>
</tr>
<tr>
<td>2</td>
<td>30%Polyester wastes</td>
<td>13/1</td>
<td>21</td>
<td>45</td>
<td>4358</td>
<td>6</td>
<td>3/5</td>
<td>219</td>
</tr>
<tr>
<td>3</td>
<td>70%Cotton wastes</td>
<td>17/1</td>
<td>24</td>
<td>31</td>
<td>2281</td>
<td>8</td>
<td>3/5</td>
<td>195</td>
</tr>
<tr>
<td>4</td>
<td>30%Polyester wastes</td>
<td>6/1</td>
<td>14</td>
<td>62</td>
<td>8287</td>
<td>6</td>
<td>3/5</td>
<td>286</td>
</tr>
<tr>
<td>5</td>
<td>40% chorisia 30%Cotton wastes</td>
<td>13/1</td>
<td>21</td>
<td>52</td>
<td>4552</td>
<td>4</td>
<td>3/5</td>
<td>186</td>
</tr>
<tr>
<td>6</td>
<td>30%Polyester wastes</td>
<td>17/1</td>
<td>24</td>
<td>41</td>
<td>2893</td>
<td>3</td>
<td>3/5</td>
<td>176</td>
</tr>
</tbody>
</table>

3-1 The effect of chorisia fibers on tearing strength / kg for the fabrics:
By comparing the results of the tests as shown in Table 2 and Fig 1, The samples of fabrics containing Chorisia fibers recorded higher values for the tearing strength in the weft direction than those not containing Chorisia fibers at the same weft counts due to scouring and the use of caustic soda solution and a result of the presence of 40% ratio of Chorisia fibers which are hollow with thin wall causing more absorption of caustic soda solution by the fabrics containing the Chorisia fibers than the fabrics that do not contain them. During the absorption of caustic soda solution, the crystalline regions become more than the uncristalline regions where the crystalize regions are responsible for the fabric tenacity and this led to the increase of resistance of the tearing strength of the fabrics.

![Figure 1 The effect of chorisia fibers ratio on tearing strength kg/f for the fabrics after bleaching](image)

3-2 The effect of chorisia Fibers on the ring wear / turn for the fabrics:
By comparing the results of the tests as shown in Table 2 and Fig. 1, The samples of fabrics containing Chorisia fibers recorded higher values for the ring wear than those not containing Chorisia fibers at the same weft counts, the number of turns of sample No. 4 is higher than the number of turns of sample No. 1 at the same weft count 6/1, meaning that the ring wear of sample No. 4 with another surface making three holes is higher than the ring wear of sample No. 1 for making the
same three holes. The same applies to the rest of the samples (5, 2) and (6, 3) as shown Table 2 and this is due to the presence of Chorisia fibers treated with alkali in the scouring process, which led to an increase in the tenacity of fabrics and increased resistance of the ring wear in weft direction.

![Image: Figure 2](image_url)

**Figure: 2** The effect of chorisia fibers ratio on the ring wear/turn for the Fabrics after bleaching

### 3-3 The effect of chorisia fibers on the absorption time/sec for the fabrics:
By comparing the results of the tests of absorption of samples of fabrics, it was found that samples No. 4, 5 and 6 recorded lower values for the time of water absorption (higher absorption speed) than the samples 1, 2 and 3 after removing the lignin, wax and oils in the scouring and bleaching process as shown in Table 2 and Fig. 3. This is due to the presence of wefts containing Chorisia fibers with thin wall and large lumen which facilitates the penetration of water and its spread more quickly resulting in an increase of absorbability.

![Image: Figure 3](image_url)

**Figure: 3** The effect of chorisia fibers ratio on the absorption time/sec of the fabrics after bleaching

### 3-4 The effect of chorisia fibers on pilling degree for the fabrics:
According to the results of the pilling test of the sample fabrics as shown Table 2 and Fig. 4, there are no differences between the pilling of samples containing the Chorisia fibers and their counterparts not containing them at the same weft counts. The pilling value for all samples recorded 3/5 which is considered an acceptable value given the fact that the wefts are a blend of wastes and it was expected for the samples containing the Chorisia fibers to give higher pilling values because they are light and short fibers. This can perhaps be explained by the fact that after the alkali treatment of the samples in the scouring process and increasing the strength of the samples containing the Chorisia fibers shrinking increased, and their integration into the woven fabric and thus improving its resistance to pilling. In addition, the weave construction of samples of fabrics is plain 1/1 and its float weave is short which led to the integration of the fibers inside the fabrics thus increasing resistance of pilling.
The blended fabrics samples
70% Cotton - 30% Polyester
40% Chorisia - 30% Cotton - 30% Polyester

3-5 The effect of chorisia fibers ratio on the weight g/ m² for the fabrics:
According to the results of the weight m² test of the sample fabrics as shown Table 2 and Fig. 5 there are differences between the weight g/ m² samples containing the Chorisia fibers and their counterparts not containing them at the same weft counts. The samples that contain chorisia fibers recorded lower results than those that do not contain chorisia fibers and the reason is that the chorisia fibers have large lumen and thin wall so their density is low.

IV. CONCLUSION
The presence of a ratio of Chorisia fibers in wefts led to an improvement in some properties of fabrics after bleaching which contained strong alkaline solutions. It is known that when treating fabrics containing cotton with alkali this increases its tenacity. The existence of a ratio of Chorisia fibers led to increased tearing strength in the direction of wefts as well as ring wear of fabrics and less resistance to absorption compared with samples of fabrics that do not contain Chorisia. After the bleaching process which is known to lead to an increased absorbability of fabrics that increased more with the presence of Chorisia due to the presence of a large lumen of the fibers thus increasing their absorption of scouring and bleaching solutions, so the properties of fabrics containing Chorisia fibers improved. All fabric samples were equal regarding the pilling value which is considered an acceptable value because they are a blend of wastes.

REFERENCES


[10] Yassin, S., Li, Z., Finishing effect on warmth property of cotton/kapok blended knitted fabric, Journal of Donghua University, Shanghai 201620, China, 32(04), 2015, 620-625


