Effect of Loom Sophistication and Blend Composition on Fabric Characteristics

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The effect of loom sophistication and blend composition (Terene/wool/viscose) on fabric properties, such as air permeability, appearance, smoothness, fullness, finge, flexural rigidity, crease recovery, abrasion resistance, and tensile strength, was studied. Eight fabric samples were prepared by using 2/2 twill and by varying the blend composition of weft (Terene/wool/viscose) on Sulzer and Saurer looms. There was no significant difference in the properties of fabrics produced on the two looms except for smoothness, appearance, fullness and finge, which were found to be better in fabrics produced on a Sulzer loom. With increase in wool component in the yarn, flexural rigidity and abrasion resistance decreased, whereas air permeability, crease recovery and tensile strength increased.

Keywords: Blend composition, Fabric characteristics, Loom sophistication, Saurer loom, Sulzer loom

The purpose of blending is initially to produce yarn of quality that cannot be obtained by using only one type of fibre. Polyester has excellent properties, such as high tenacity, elongation, better dimensional stability and crease recovery, which contribute to the long life of the fabric. The only drawback of polyester fibre is that it is hydrophobic and hence fabrics are very uncomfortable in summer and dry seasons. To overcome this defect the polyester fibre is blended with hydrophilic fibres, such as cotton, viscose and wool, so as to produce fabrics for apparel wear.

To produce the fabric for use in winter, the polyester is blended with wool, which has better warmth, and the blending results in a fabric with better dimensional stability, drapability, abrasion resistance and warmth. The different properties can be obtained by varying the blend composition of Terene/wool/viscose in the fabrics.

Moreover, the fabric's static properties are influenced to a great extent by the type and sophistication of machine on which it has been produced. This study was aimed at determining the effect of loom sophistication and blend composition of Terene/wool/viscose on fabric properties.

Materials and Methods

Eight fabric samples were prepared using 2/2 twill weave and 76 ends/in. from 2/52s warp count. Of these, four were prepared on a Sulzer loom and the other four on a Saurer loom. Four samples had a weft count of 2/52s with the blend percentages of Terene/wool being 55/45, 40/60 and 70/30 and Terene/wool/viscose being 50/30/20 with 50 picks/in. The warp count, weft count, ends/in., picks/in., etc. were kept constant in all the cases, and the fabric samples were finished under identical conditions. All the fabrics were given a Terene/wool/viscose finish.

The Sulzer loom (model 85/VSD/125/KT) was used for preparing the sample with a reed space of 85 in. with a four-colour changing device, tuck-in selvedge motion and toggle torsion bar-picking mechanism; and a Saurer loom of Swiss make was used with 72 in. reed space with Climax dobby mechanism, crank-shaft beat-up motion and pick-up by means of a heavy shuttle (1 lb).

Prior to testing, all the samples were conditioned in standard atmosphere (RH 65 ± 2% and 27 ± 2°C) for 48 h. Standard test methods (British standard specifications1–3) were used for determining the fabric characteristics. The air permeability of the fabrics was tested on a Metefem type ATL-2 (FF-12). The bending length and crease recovery angle of the sample were measured on a Shirley stiffness tester and Shirley crease recovery angle tester respectively in conformity with the British Standard. The tensile strength was tested on a German tensile strength tester, based on the principle of constant rate of traverse, whereas the flex abrasion resistance was measured on a B.F.T. abrasion testing machine. The fabric appearance, smoothness, fullness and finge were subjectively tested by five judges and the degree of agreement among the ranks given by the judges was measured by calculating the coefficient of concordance as given by

$$W = \frac{S}{m^2 (n^3 - n)/12}$$

where S is the sum of the squares of the differences; m,
the number of judges; and $n$, the number of samples. The significance of the coefficient of concordance was tested by $F$ tables and then final rankings were made by considering rank totals.

**Results and Discussion**

**Effect of Loom Sophistication on Fabric Properties**

The data obtained for the fabrics prepared on Sulzer and Saurer looms (Tables 1 and 2) show no significant difference in mechanical properties of the two fabrics. However, the aesthetic properties like appearance, smoothness, fullness and finge of the Sulzer fabric were better than those of the Saurer fabric. This is because the mechanical properties are governed by the yarn and fabric construction which are the same in both the cases.

The superiority of the aesthetic properties of the Sulzer fabric can be explained on the basis that the Sulzer loom is a shuttle-less loom and there is positive control over warp let-off and take-up, leading to uniform warp tension and better control on the weft insertion.

**Effect of Blend Composition on Fabric Properties**

**Air permeability**—It is observed from Table 2 that with increase in wool component in the blend the air permeability increases. This can be explained on the basis that the wool is bulkier, so the yarn produced with a higher percentage of wool will be bulkier and porous in nature and hence a greater amount of air can flow through the fabric produced from these yarns with a high percentage of wool.

**Flexural rigidity**—Table 2 shows that the flexural rigidity increases with decrease in wool component in the yarn. It is well known that the fabric stiffness depends upon the stiffness of the fibre from which it is produced. Polyester being a stiffer fibre than wool, flexural rigidity of the fabric increases when the percentage of the wool component in the yarn is reduced.

**Crease recovery angle**—Data on the crease recovery angle (Table 2) show that crease recovery of the fabric decreases with increase in the polyester component in the yarn. Crease recovery is fundamentally related to the elastic recovery of the yarn and fibres. Since wool has better elastic recovery than polyester fibre, an increase in polyester component reduces crease recovery.

**Flex abrasion resistance**—Table 2 shows that the abrasion resistance of the fabric decreases as the wool component increases. The abrasion property depends upon the properties of yarn and the fibre from which the fabric is produced. Since polyester has greater abrasion and wool is bulkier in nature, the fabric produced from the yarn with a higher percentage of polyester will have better abrasion resistance than the one produced from yarn with a lower polyester component.

**Tensile strength**—Table 2 also shows that with increase in the wool component the fabric tensile strength both in warp and weft directions increases. This is because the fibre-to-fibre friction in yarn is more in the case of wool owing to its rough surface and scale properties. Hence there is less slippage between

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**Table 1—Subjective Assessment of Aesthetic Properties of Sulzer and Saurer Fabrics**

<table>
<thead>
<tr>
<th>Property</th>
<th>Sulzer Fabric</th>
<th>Saurer Fabric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Smoothness</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Fullness</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Finge</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

**Table 2—Mechanical Properties of Sulzer and Saurer Fabrics**

<table>
<thead>
<tr>
<th>Fabric sample No.</th>
<th>Blend percentage used in weft yarn T : W : V</th>
<th>Air permeability $m^3/min/m^2$</th>
<th>Overall flexural rigidity $mg-cm$</th>
<th>Crease recovery angle deg</th>
<th>Flex abrasion resistance $P$</th>
<th>Tensile strength kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>SULZER LOOM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>55/45/0</td>
<td>74.43</td>
<td>216.6</td>
<td>304.0</td>
<td>0.985</td>
<td>136.0</td>
</tr>
<tr>
<td>2</td>
<td>40/60/0</td>
<td>78.88</td>
<td>220.1</td>
<td>308.1</td>
<td>0.886</td>
<td>147.0</td>
</tr>
<tr>
<td>3</td>
<td>50/30/20</td>
<td>77.49</td>
<td>244.4</td>
<td>294.1</td>
<td>0.956</td>
<td>141.0</td>
</tr>
<tr>
<td>4</td>
<td>70/30/0</td>
<td>73.33</td>
<td>231.1</td>
<td>299.0</td>
<td>1.093</td>
<td>121.5</td>
</tr>
<tr>
<td>SAURER LOOM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>55/45/0</td>
<td>74.96</td>
<td>117.3</td>
<td>294.0</td>
<td>0.886</td>
<td>128.0</td>
</tr>
<tr>
<td>2</td>
<td>40/60/0</td>
<td>79.16</td>
<td>112.7</td>
<td>302.6</td>
<td>0.820</td>
<td>139.0</td>
</tr>
<tr>
<td>3</td>
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<td>78.88</td>
<td>124.8</td>
<td>287.1</td>
<td>0.850</td>
<td>127.0</td>
</tr>
<tr>
<td>4</td>
<td>70/30/0</td>
<td>74.99</td>
<td>126.4</td>
<td>291.6</td>
<td>0.941</td>
<td>121.0</td>
</tr>
</tbody>
</table>

T-Terene; W-Wool; V-Viscose
fibres when rupture of yarn takes place and ultimately yarn strength increases owing to high frictional forces arising at contact points in wool. In the case of polyester, because of its smooth surface, fibre slippage takes place at contact point, resulting in low yarn strength. So fabric strength increases with increase in the wool component in yarn owing to better fibre and yarn assistance, i.e., due to less freedom of movement of fibres in yarn and of yarns in fabric.

**Fabric aesthetic properties**—To study the fabric aesthetic properties, subjective assessment of the fabric's appearance, smoothness, fullness and finge was made. Table 3 shows that fabric appearance, fullness and finge are better in the case of the sample produced from the yarn with a higher percentage of wool as compared to others. The aesthetic property deteriorates with decrease in the wool component. This can be explained on the basis that wool being a bulkier and resilient fibre, the fullness and finge properties of the fabric produced from the yarns with a higher percentage of wool will be better than the one produced from the yarns with lower percentage of wool.

### Conclusions

1. The sophistication of the weaving machine affects significantly the aesthetic properties of the fabric. The fabric produced on a Sulzer loom has better appearance, smoothness, fullness and finge than the fabric produced on a Saurer loom.
2. With increase in wool component in blend yarn, air permeability of the fabric increases.
3. The flexural rigidity of the fabric decreases with increase in the wool component in the yarn.
4. The crease recovery angle increases with increase in the wool component.
5. The flex abrasion resistance decreases with increase in the wool component.
6. With increase in the wool component, both the warp and weft tensile strengths of the fabric increase.
7. With increase in the wool component, the fabric aesthetic properties like appearance, smoothness, fullness and finge improve.

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### References