Response of Short Staple Indian Cottons to Crosslinking

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The wrinkle resistance and tensile properties of untreated as well as formaldehyde crosslinked short staple Indian cottons differing widely in fineness have been measured. The results show that fine cottons exhibit a marginally better balance of crease recovery and tensile properties than coarser cottons, more or less of the same staple length and strength.

The changes in the strength and recovery properties of fabrics chemically modified to impart durable press properties have been attributed mainly to the changes in the individual fibres themselves and studies have been initiated to assess the contribution of each of the fibre parameters. In earlier communications\(^1\),\(^2\), the results of studies on the effect of fibre maturity, breaking tenacity and pretreatments on the improvement in dry crease recovery as well as wear life of the crosslinked fibres were reported. In this paper, the effect of fineness on the recovery and tensile properties of short staple Indian cottons as a consequence of formaldehyde crosslinking is discussed.

Experimental Procedure

Cotton — Fine and coarse short staple Indian cottons were selected for this study. These cottons were purified by soxhlet extraction in a mixture of benzene and ethyl alcohol in the ratio 2 : 1.

Crosslinking — The fibres were formaldehyde crosslinked employing the formaldehyde process\(^3\). The treatment period was varied so as to obtain a range of bound formaldehyde and consequently a range of conditioned crease recovery angles.

Test methods — The breaking strengths at 0 and 1/8 in test lengths were determined using a Stelometer (ASTM specification, D 1445-67) and the bundle crease recovery angles were measured by the method of Venkatesh and Dweltz\(^4\).

Results and Discussion

The cottons chosen for the study differ widely in fineness and vary very little in other properties (Table 1). Because of the short staple length of these cottons, fibre pads of 2 cm length could not always be prepared, especially in the case of cotton fibres with very high bound formaldehyde contents, and consequently, measurements of crease recovery angles in such cases could be carried out with a test length of 1.0 cm instead of the usual test length of 1.5 cm. However, such a change in test length was not observed to affect the measured angles appreciably, as shown earlier\(^4\).

In some cases, the bundle strength at 1/8 in test length could not be measured using a Stelometer for the same reasons. In spite of these limitations, the comparison between fibre properties is still quite meaningful.

Fig. 1 shows the relationship between the dry crease recovery angles and percentage bound formaldehyde levels. The relationship for Karnak, a long staple, fine Egyptian cotton is also shown for comparison. It is seen from Fig. 1 that among the short staple cottons, Laxmi exhibits the maximum improvement in crease recovery angle at any level of bound formaldehyde followed by B 1007, Digvijay and Kalyan. These improvements are, however, less than those realized in the case of the long staple Karnak cotton. The losses in breaking strength of fibres as a result of crosslinking are plotted against the bound formaldehyde content in Fig. 2. It is seen that the fine cottons (Laxmi and B 1007) have undergone higher losses in their breaking strength than the coarser ones at comparable bound formaldehyde levels. However, consideration of both crease recovery angle and re-

<table>
<thead>
<tr>
<th>Cotton</th>
<th>Effective length mm</th>
<th>Grav. fineness g/in</th>
<th>Bundle tenacity, g/tex</th>
<th>Crease recovery angle, deg</th>
<th>Tensile loss %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 in</td>
<td>1/8 in</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Laxmi</td>
<td>25.8</td>
<td>3.5</td>
<td>45.5</td>
<td>19.2</td>
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<tr>
<td>B 1007</td>
<td>26.2</td>
<td>3.6</td>
<td>46.7</td>
<td>20.1</td>
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<tr>
<td>Digvijay</td>
<td>24.1</td>
<td>4.6</td>
<td>47.7</td>
<td>22.2</td>
<td>79</td>
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<tr>
<td>Kalyan</td>
<td>24.0</td>
<td>6.4</td>
<td>42.8</td>
<td>16.6</td>
<td>74</td>
</tr>
</tbody>
</table>

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Fig. 1 — Plots of $\Delta CR$ versus percentage bound formaldehyde.

Fig. 2 — Percentage tensile loss vs percentage bound formaldehyde.

Fig. 3 — Improvements in crease recovery vs percentage tensile losses.

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References