CHAPTER 6

INFLUENCE OF WEAVE FACTOR ON WICKING

6.1 INTRODUCTION

The various factors such as fibre, its linear density, thread density, fabric construction, finishes, and the weave type of fabric influence the fabric wickability. In this research work the effect of fabric weave, expressed by weave factor $P_1$, on fabric wickability is discussed.

All parameters of the fabric structure (warp and weft raw material, warp and weft linear densities, warp and weft settings and fabric weave) influence many mechanical and end-use properties. Various scientists have studied the influence of fabric structure on various end-use properties.

Nikolic et al (2000) expressed fabric strength by the thread strength, fabric setting, and thread strength coefficient. It was established that, with an increase in thread strength, the fabric strength also increased. The fabric strength in the warp direction was higher than that in the weft.

Olšauskienė et al (2003) analyzed the influence of a fabric structure on its air permeability and abrasion resistance. They established that when a fabric’s structure stiffens, its air permeability decreases, and abrasion resistance increases.

Wang et al (2005) evaluated mechanical warp and weft interaction during shearing, as well as establishing theoretical dependencies between shearing rigidity and fabric structure.
Frydrych et al (2000) analyzed the influence of finishing, raw material and weft setting on fabric elongation at break. They established the dependence between the change in friction and the area of warp and weft thread contact.


The different experiments mentioned above were conducted with the aim of studying various fabric properties, but the properties of fabric wickability, especially their relation to fabric structure, were not investigated in detail. In this research work, the influence of weave factor on fabric wicking is investigated.

Milašius et al (2008) proposed the weave factor $P1$. It is calculated directly from the weave matrix and has excellent correlation with other weave factors. The calculation of Milašius weave factor $P1$ is very complicated and time consuming when done by hand. Hence, using a website http://www.textiles.ktu.lt/Pagr/En/Cont/pagrE.htm the computation was done.

In this research work the influence of Milašius weave factor $P1$ on fabric wicking is investigated by a novel method. The value of the weave factor $P1$ can vary from 1 to 2 depending on the density of the fabric structure, i.e. with an increase in the density of the fabric structure; the weave factor $P1$ approaches the value 1.
6.2 MATERIALS AND METHODS

To conduct the above mentioned experiments, the fabrics were, woven on a projectile sample loom using Polyester/Viscose blend 65/35, 19.5 tex, 2 ply, warp density 23.6 ends/cm, weft density 23.6 picks/cm. The fabrics were woven in 12 different weaves as shown in Figure 6.1. The weaves were chosen in such a way, that they could be woven with the same loom setting. The weave factor $P1$ of all chosen weaves was changed to the widest possible range (from 1 to 1.9). From the chosen weaves, six weaves (1, 2, 4, 5, 6, 7) had floats evenly distributed through the full fabric surface, and six weaves (3, 8, 9, 10, 11, 12) were horizontally striped. These have floats as compared to above weaves.

![Image](image-url)

Figure 6.1 Weaves used in experiment

A1 – plain weave ($P1 = 1$); A2 – weft rib ($P1 = 1$); A3 – warp rib ($P1 = 1.31$); A4 – twill 2/2 ($P1 = 1.26$); A5 – weft direction Bedford cord ($P1 = 1.27$); A6 – fancy twill ($P1 = 1.11$); A7 – sateen ($P1 = 1.79$); A8 – basket weave ($P1 = 1.88$); A9 – broken twill ($P1 = 1.18$); A10 – crape weave ($P1 = 1.41$); A11 – warp direction Bedfordcord ($P1 = 1.18$); A12 – mock leno ($P1 = 1.12$)
6.3 RESULTS AND DISCUSSIONS

6.3.1 Effect of Type of Fabrics on Wicking

In order to establish the influence of fabric weave on fabric wickability, vertical wicking tests were carried out (MPVWT) using fabrics of two types. Values of the weave factor $P1$ for the 12 woven fabrics and the wicking time in seconds to rise to 5cm height for both warp and weft directions are shown in Table 6.1. It is observed that the character of fabric wicking, whose floats are distributed evenly throughout the entire fabric surface, and of horizontally striped fabric were different. It is apparent that A1, which is a plain weave, has shown poor wickability considering all weaves. In A7 which is a satin fabric the wickability is found to be good. This is in agreement with the findings of Sharabaty et al (2008).

Table 6.1 Values of the weave factor $P1$ and Wicking time with different weaves

<table>
<thead>
<tr>
<th></th>
<th>Fabric Code</th>
<th>$P1$</th>
<th>Vertical Wicking time in seconds (5cm Height) Warp Direction</th>
<th>Vertical Wicking time in seconds (5cm Height) Weft Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evenly distributed floats</td>
<td>A1</td>
<td>1</td>
<td>92</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>A2</td>
<td>1</td>
<td>59</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>A6</td>
<td>1.10</td>
<td>89</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>A4</td>
<td>1.26</td>
<td>75</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>A5</td>
<td>1.27</td>
<td>73</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>A7</td>
<td>1.78</td>
<td>49</td>
<td>48</td>
</tr>
<tr>
<td>Horizontally striped fabrics</td>
<td>A12</td>
<td>1.12</td>
<td>54</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>A9</td>
<td>1.17</td>
<td>43</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>A11</td>
<td>1.17</td>
<td>44</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>A3</td>
<td>1.30</td>
<td>80</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>A10</td>
<td>1.41</td>
<td>40</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>A8</td>
<td>1.88</td>
<td>49</td>
<td>52</td>
</tr>
</tbody>
</table>
Figure 6.2 Effect of types of fabrics on wicking

Figure 6.2 shows that fabrics with evenly distributed floats wicks slower and horizontally striped fabrics wick faster except for warp rib fabric (A3). This is due to the presence of floats in horizontally striped fabrics. This irregular structure may be the reason why the rate of wicking is higher for the horizontally striped fabrics. Due to the floats there are slight variations observed in rate of warp and weft way wicking and in some cases the rate of weft way wicking are higher than that of warp way wicking. This may be due to the tension variations of warp and weft threads and crimp levels.

6.3.2 Effect of weave factor $P1$ on fabric wicking (warp direction)

The effect of fabric weave factor $P1$ on the fabric wicking is analyzed for both warp and weft way directions. In plain woven fabric, the warp way interlacements are less and hence wickability is poor.

Figure 6.3 shows the wickability in respect of evenly distributed floats and horizontally striped fabrics, while the relationship between
wickability and P1 weave factor obtained for evenly distributed floats is found to be excellent ($R^2 = 0.975$), the opposite is the case with horizontally striped fabric ($R^2 = 0.001$).

The regression analysis results of the P1 weave factor and wicking for evenly distributed floats in warp and horizontally striped fabrics direction are given in Table A.1.1 and A.A.2 (Appendix 1).

However, in this case, we ignored the points of the warp and weft rib weaves, because these weaves are non-standard and their results significantly affect the resulting dependencies.

![Graph](image)

**Figure 6.3 Effect of weave factor $P1$ on fabric wicking (warp direction)**

Brierley (1952) and Galuszynski (1981) considered rib weaves as specific instances, to which the formulas valid for other weaves do not apply.
6.3.3 Effect of weave factor $P1$ on fabric wicking (weft direction)

Weft way wicking of fabrics in respect of evenly distributed floats and horizontally striped weaves is shown in Figure 6.4.

![Diagram showing the effect of weave factor on fabric wicking](image)

**Figure 6.4 Effect of weave factor on fabric wicking $P1$ (Weft direction)**

The same trend is followed in weft direction also. As the $P1$ weave factor increases the rate of wicking also increases for the evenly distributed floats. High correlation between $P1$ weave factor and wickability ($R^2=0.946$) for evenly distributed floats was obtained. The regression analysis results of the $P1$ weave factor and wicking for evenly distributed floats in weft direction are given in Table A.1.3 (Appendix 1)

There are slight variations observed in the rate of wicking for the horizontally striped fabrics. The influence of $P1$ weave factor on fabric wicking was found to be poor as determination coefficient of dependence ($R^2 = 0.707$) is low for the horizontally striped fabrics. The Regression analysis
results of the $P1$ weave factor and wicking for horizontally striped fabrics in weft direction are given in Table A.1.4 (Appendix 1).

### 6.3.4 Overall dependencies of weave factor $P1$ on fabric wicking

After summarizing all the weaves, the overall dependence is shown in Figure 6.5 which shows that as $P1$ weave factor increases, wickability increases.

The influence of $P1$ weave factor on fabric wicking is weak as the correlation coefficient between them are very poor $R^2 = 0.2315$ and 0.344 respectively. We can assert that, after summarization of all the weave points, the relation between the fabrics wicking and fabric weave factor $P1$ has not been established. Underlying reasons, leading to these results, are difficult to explain at this point. The regression analysis results of the $P1$ weave factor and wicking in warp and weft direction are given in Table A.1.5 and A.1.6 respectively (Appendix 1)

![Graph showing overall effect of weave factor $P1$ on fabric wicking](image)

**Figure 6.5 Overall effect of weave factor $P1$ on fabric wicking**

\[ y = -32.141x + 103.27 \quad R^2 = 0.2315 \]

\[ y = -39.102x + 110.97 \quad R^2 = 0.344 \]
6.4 CONCLUSION

After weaving fabrics with projectile desk loom from P/V 19.5 tex twisted 65/35 blended yarn in different weaves and conducting vertical wicking on these fabrics, we can come to these conclusions:

1. It is noticed that of all the weaves examined, plain weave shows poor wickability.

2. Character of fabric wicking in weaves with evenly distributed floats and horizontally striped weaves is different.

3. Wicking rate of fabrics in weaves with evenly distributed floats is lower than those in horizontally striped weaves.

4. As weave factor $P_I$ increases, the rate of wicking also shows an increase.

5. Good correlation is observed between the weave factor $P_I$ and the rate of wicking for evenly distributed floats in both warp and weft directions.

6. The influence of weave factor $P_I$ on rate of wicking was not established for horizontally striped fabrics for both warp and weft directions.

7. The overall dependence of fabrics wicking on the weave factor $P_I$ was not established.