## Fiber Properties Comparison

<table>
<thead>
<tr>
<th>FIBER PROPERTY</th>
<th>NYLON 6</th>
<th>PET</th>
<th>PLA</th>
<th>RAYON</th>
<th>COTTON</th>
<th>SILK</th>
<th>WOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity</td>
<td>1.14</td>
<td>1.39</td>
<td>1.25</td>
<td>1.52</td>
<td>1.52</td>
<td>1.34</td>
<td>1.31</td>
</tr>
<tr>
<td>Tg (°C)</td>
<td>90</td>
<td>125</td>
<td>55 - 60</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tm (°C)</td>
<td>215</td>
<td>255</td>
<td>130 - 175</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Tenacity (g/d)</td>
<td>5.5</td>
<td>2.4 - 7.0</td>
<td>2.0 - 6.0</td>
<td>2.5</td>
<td>4.0</td>
<td>4.0</td>
<td>1.6</td>
</tr>
<tr>
<td>Moisture Regain (%)</td>
<td>4.1</td>
<td>0.2 - 0.4</td>
<td>0.4 - 0.6</td>
<td>11</td>
<td>7.5</td>
<td>10</td>
<td>14 - 18</td>
</tr>
<tr>
<td>Elastic Recovery (5% strain)</td>
<td>89</td>
<td>65</td>
<td>93</td>
<td>32</td>
<td>52</td>
<td>52</td>
<td>69</td>
</tr>
<tr>
<td>Heat of Combustion (MJ/kg)</td>
<td>3.1</td>
<td>25 - 30</td>
<td>19</td>
<td>17</td>
<td>17</td>
<td>-</td>
<td>21</td>
</tr>
<tr>
<td>Flammability</td>
<td>Medium smoke; Burns 6 min. after flame removed</td>
<td>High smoke; Burns 2 min. after flame removed</td>
<td>Burns</td>
<td>Burns</td>
<td>Burns</td>
<td>Burns slowly; Self-extinguishing</td>
<td></td>
</tr>
<tr>
<td>LOI (%)</td>
<td>20 - 24</td>
<td>20 - 22</td>
<td>26 - 35</td>
<td>17 - 19</td>
<td>16 - 17</td>
<td>-</td>
<td>24 - 25</td>
</tr>
<tr>
<td>UV Resistance</td>
<td>Poor</td>
<td>Fair</td>
<td>Excellent</td>
<td>Poor</td>
<td>Fair - Poor</td>
<td>Fair - Poor</td>
<td>Fair</td>
</tr>
<tr>
<td>Refractive Index</td>
<td>1.52</td>
<td>1.54</td>
<td>1.35 - 1.45</td>
<td>1.52</td>
<td>1.53</td>
<td>1.54</td>
<td>1.54</td>
</tr>
<tr>
<td>Contact Angle (ø)</td>
<td>70</td>
<td>82</td>
<td>76</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Wickinig (L-W slope)</td>
<td>-</td>
<td>0.7 - 0.8</td>
<td>6.3 - 7.5 (no finish); 19 - 26 (with finish)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Fiber and fabric properties

Key Points from Fiber Comparisons

**Positives:**
- PLA is the only melt processable natural based polymer
- PLA has a lower specific gravity than natural fibers
- Optical composition allows control of crystalline melting point
- The tenacity of PLA is higher than natural fibers
- Moisture regain of PLA is significantly lower than natural fibers
- Elastic recovery is superior to all other fibers compared at 5% strain
- PLA has a lower heat of combustion than PET
- Burns with lower smoke than synthetic polymers compared
- PLA has outstanding UV resistance
- PLA has a low refractive index which produces intense colors on dyeing
- The low contact angle compared with PET leads to improved wicking with water
- PLA shows faster moisture spread than PET

**Negatives:**
- Poor alkali resistance causes strength loss in conventional disperse dye process
- Low crystalline melt temperature leads to low ironing temperature

Reference for Properties in Table

**specific gravity**
- Nylon 6, Nylon 6-6, PET, Rayon, Cotton, Silk, Wool, Acrylic-Fiber Science; Warner, Steven B.; Prentice-Hall, 1995; p. 40.
- PLA-NatureWorks Internal Reports

**Tm**
- PLA-NatureWorks Test Data, sample 015-015-05; ASTM E-1356; NatureWorks Internal Reports

**tenacity**

**moisture regain**
- Nylon 6, Nylon 6-6, PET, Cotton, Silk, Wool, Acrylic-ASTM D-2654-89a, Fiber Science; Warner, Steven B.; Prentice-Hall, 1995; p. 105.
- PLA-University of Nebraska Research Report; ASTM D-2654-89a; Dr. Lois Scheyer; November 24, 1998.
fiber and fabric properties

Reference for Properties in Table (cont’d)

**elastic recovery**
Nylon 6, PET, Rayon, Cotton, Silk, wool, acrylic-5% strain, ASTM D1774-94; Fiber Science; Warner, Steven B.; Prentice-Hall, 1995

**heat of combustion**
PLA-Cargill Research Report by S. Chessen; Also Akzo Nobel Report; ASTM E1354-90

**flammability**
Cotton, PET, PLA-Testing done by VTEC Report of Results; ASTM E-1354
Generic Descriptions, other various fibers; Various sources

**LOI%**
PLA-Reports by VTEC and Akzo; ASTM D-2863.

**UV resistance**

**refractive index**
Rayon, cotton, wool, Nylon, PET-Fiber Science; Warner, Steven B.; Prentice-Hall, 1995; p. 217
PLA-High Speed Spinning; Tokyo Institute of Technology; Dr. Takahashi, 1/06/00

**contact angle, wicking**
PLA, PET-TRI report, ARS #689 10/1998