TEXAS TECH UNIVERSITY
International Textile Center

Summary Report on Fabric Tests Done for Parkdale Mills

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This is to report on the testing results regarding the fabrics sent to us, which are labeled as follows:

1. 30/1 CP Delta RS
2. 30/1 CP Delta CS
3. 30/1 KP Delta RS
4. 30/1 KP Delta CS
5. 30/1 CP Cal RS
6. 30/1 CP Supima RS
7. 60/2 CP Cal RS M
8. 60/2 CP Supima RS M

Where:
CP ≡ combed
KP ≡ carded
RS ≡ ring-spun, conventional
CS ≡ ring-spun, compact
M ≡ mercerized
Delta ≡ Mid-South Upland cotton
Cal ≡ California Upland (Acala) cotton
Supima ≡ California Pima cotton

Results are given for the following tests:

1. ASTM D3776 weight per sq. yd.
2. ASTM D3775 courses and Wales
3. ASTM D3787 ball burst
4. ASTM D3774 width
5. ASTM 3512 random tumble pill
6. AATCC 135 shrinkage
7. AATCC 16-2004 light fastness
8. AATCC 61 colorfastness to laundering, home and commercial condition 2A
9. AATCC 116 colorfastness to crocking-rotary vertical crock meter method.
10. AATCC evaluation procedure percentage of color retention by measuring DEcmc after 5 and 20 cycles.

In the next several paragraphs, I will explain and comment on the results obtained, with the objective of clarifying the meaning and implications of the results.

Table 1 summarizes the structural measurements on the fabrics and gives the results of the pilling test. I think all of the structural measurements are self-explanatory. These were all double-checked to ensure accuracy of our measurements; therefore, we are confident that these structural properties "are what they are." The only data that stand out are the ball burst strength results for the ring-spun Supima cotton fabric.

The "tumble pill' results are expressed on a 5-point scale:

5 ⇒ No Pilling
4 ⇒ Slight Pilling
3 ⇒ Moderate Pilling
2 ⇒ Severe Pilling
1 ⇒ Very Severe Pilling

The rule-of-thumb for interpretation of results is that a score of 4 or higher means that the fabric will perform satisfactorily; i.e., that consumers will not perceive a problem. Therefore, all fabrics performed satisfactorily and there was no significant difference among them.

Table 1. Structural Characteristics of Fabrics and Pilling Results

Sample ID	ASTM D3776 Weight (oz/yd^2)	ASTM D3775 Course & Wale Counts	ASTM D3787 Ball Burst (lbf)	ASTM D3774 Width (in)	ASTM 3512 Tumble Pill
1. 30/1 CP Delta RS	3.6	Courses: 40 Wales: 37	Course: 68.9 Wale: 73.3	29	4
2. 30/1 CP Delta CS	3.6	Courses: 40 Wales: 37	Course: 74.1 Wale: 64.9	28	4
3. 30/1 KP Delta RS	3.4	Courses: 40 Wales: 37	Course: 56.5 Wale: 57.4	28	4
4. 30/1 KP Delta CS	3.4	Courses: 37 Wales: 37	Course: 54.6 Wale: 60.5	27	4
5. 30/1 CP Cal RS	3.4	Courses: 39 Wales: 37	Course: 74.6 Wale: 74.5	27	4
6. 30/1 CP Supima RS	3.7	Courses: 37 Wales: 37	Course: 103.4 Wale: 103.8	27	4
7. 60/2 CP Cal RS M	3.6	Courses: 41 Wales: 35	Course: 84.0 Wale: 76.9	29	5
8. 60/2 CP Supima RS M	3.5	Courses: 42 Wales: 37	Course: 74.6 Wale: 81.0	28	4

On the dimensional change measures (Table 2), we concluded that three measurements were needed: Shrinkage in the courses, shrinkage (or stretching) in the wales, and skew. The skew direction and percentage indicates the way and the amount that the laundered fabric distorts from its original, square shape. The skew was both substantial and variable; it ranged from 10.0% to 27.4%. As usual, most of the shrinkage occurred in the courses of the fabric, ranging from -11.0% to -16.7%.

In the wales, one of the fabrics (60/2 CP Supima M) actually stretched by +2.9%, while another (60/2 CP CAL RS M) shrank by -6.7%. Therefore, it was the mercerized fabrics that provided the extreme values on dimensional changes in the wales. The 30/1 ring-spun Supima shrank by -3.1%, with all other fabrics having shrinkages approximating -1%.

Looking at the fabrics made from Mid-south cottons, it is apparent that the shrinkage in the courses was greater for the compact spun yarns, both for combed yarns (compare 30/1 CP Delta RS versus 30/1 CP Delta CS) and carded yarns (compare 30/1 KP Delta RS versus 30/1 KP Delta CS). But there are no other patterns in the dimensional data that suggest a consistent behavior.

The column headed "ΔEcmc" gives the changes in color shade after the fabrics were exposed to light in the xenon test chamber for 20 hours and 100 hours. The column headed "Gray Scale" rates the color change as follows:

5 ⇒ No Color Change
4-5 ⇒ Slight Color Change
2-3 ⇒ Moderate Color Change
1 ⇒ Severe Color Change

These two methods of measurement are often used together, to ensure that they corroborate one another. For ΔEcmc we want to see a value below 1.80, because values below this are not detectable by humans. For Gray Scale, we want to see values between 4 and 5; this also indicates that people will not detect any color change. Therefore, all of these fabrics pass the light colorfastness tests and there is no basis for discriminating among them.

Table 2. Dimensional Stability to Laundering and Colorfastness to Light

Sample ID	AATCC 135 %Dimensional Change of Fabric after Home Laundry & Skew % and Direction	AATCC 16-2004 Colorfastness to Light Gray Scale Change	
		ΔEcmc	Gray Scale
1. 30/1 CP Delta RS	Courses: -11.0 % Wales: -0.1 % Skew: Left, 16.8%	20 hours: 1.00 100 hours: 1.08	4.2 4.2
2. 30/1 CP Delta CS	Courses: -16.2% Wales: -1.2% Skew: Left, 26.7%	20 hours: 0.43 100 hours: 0.67	4.1 4.0
3. 30/1 KP Delta RS	Courses: -11.0% Wales: -0.5% Skew: Left, 17.0%	20 hours: 0.33 100 hours: 0.70	4.1 4.1
4. 30/1 KP Delta CS	Courses: -15.7% Wales: -0.7% Skew: Left, 16.7%	20 hours: 0.33 100 hours: 0.64	4.5 4.0
5. 30/1 CP Cal RS	Courses: -16.7% Wales: -1.4% Skew: Left, 11.0%	20 hours: 0.60 100 hours: 0.88	4.3 4.0
6. 30/1 Supima RS	Courses: -14.1% Wales: -3.1% Skew: Left, 19.5%	20 hours: 0.39 100 hours: 0.94	4.3 4.2
7. 60/2 CP Cal RS M	Courses: -13.1% Wales: -6.7% Skew: Right, 10.0%	20 hours: 0.51 100 hours: 0.90	4.5 4.4
8. 60/2 CP Supima RS M	Courses: -16.0% Wales: +2.9% Skew: Right, 27.4%	20 hours: 1.01 100 hours: 1.67	4.2 4.1

Table 3 contains the results on colorfastness to laundering and crocking. The colorfast rating scales and the criterion for the ΔEcmc are the same as for the light colorfastness tests. Therefore, the results on colorfastness to laundry and to wet and dry crocking are satisfactory for all the fabrics, as are the results on ΔEcmc after 5 and 20 washings.

Table 3. Colorfastness to Accelerated Laundering and to Crocking

Sample ID	AATCC 61 Colorfastness to Laundry Home & Commercial Accelerated (2a)	AATCC Evaluation ΔEcmc after 5 & 20 Washings	AATCC 8 -2005 Colorfastness to Crocking Rotary Vertical Method
1. 30/1 CP Delta RS	5	5 Washes: 1.12 20 Washes: 1.17	Dry 5 Wet 4
2. 30/1 CP Delta CS	5	5 Washes: 1.35 20 Washes: 1.44	Dry 5 Wet 5
3. 30/1 KP Delta RS	5	5 Washes: 1.35 20 Washes: 1.42	Dry 5 Wet 4.5
4. 30/1 KP Delta CS	5	5 Washes: 1.13 20 Washes: 1.51	Dry 5 Wet 4
5. 30/1 CP Cal RS	5	5 Washes: 1.25 20 Washes: 1.31	Dry 5 Wet 5
6. 30/1 Supima RS	5	5 Washes: 1.19 20 Washes: 1.22	Dry 5 Wet 4
7. 60/2 CP Cal RS M	5	5 Washes: 1.04 20 Washes: 0.94	Dry 5 Wet 4
8. 60/2 CP Supima RS M	5	5 Washes: 1.02 20 Washes: 1.00	Dry 5 Wet 4

Conclusions

Results from the foregoing standardized fabric tests do not provide any basis for discriminating among the various fiber types or between the conventional versus compact ring spinning. Neither is there reason to favor the mercerized fabrics, based on the durability of these under the different treatments. Of course there may be reason to prefer the mercerized fabrics based on the deeper color of the dyed fabrics and the 'hand' of these fabrics. The difference is clear from inspecting the samples of each fabric that are being provided along with this report. These results from mercerization of cotton have been known for hundreds of years, so election to use this finishing process is a matter of choice based on objectives for the textile product.

There may also be subjective, esthetic reasons to select a cotton type or spinning approach based on color shading, feel, etc. These standardized, objective tests generally do not provide a basis to do so, except perhaps for the ball burst strength tests given in Table 1. Clearly the ring-spun Supima cotton results in a significantly stronger knitted fabric; however, the strengths of the other fabrics are adequate for most consumer applications of this type of fabric.