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Textile Analysis and Interpretation for Decision Making

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Textile industry is actively involved in promoting quality products for textile and apparel. Despite society's move to the casual lifestyle, need for lined garments has not disappeared. When selecting lined garments, it is of critical importance that apparel manufacturers test the appropriateness of each layer for the intended end-use and compatibility of all layers together. It is important to consider both structural and performance attributes while making such decisions from the available choices. Chowdhary [1] reported that crimp in yarn makes the synthetic filaments more resilient than the uncrimped yarns. Likewise, twist adds strength for the staple fibers when twisted to make yarns. Higher fabric count is associated with better quality than the lower count. Quality fabrics also mean defect free textiles. Breaking strength was higher for twill weave as opposed to plain and sateen weave [2]. Uttam [3] found that cotton became heavier and thicker with increased cover factor after repeated washing.

Chowdhary [4] asserted that dimensional stability can be used to determine fabric shrinkage and /or growth after care. This statement has merit because using two different fiber contents (cotton and acetate lining) for a lined garment may change differentially and allow decision-makers either to change the care procedure or choose different fabric. Horizontal wicking is also an important performance attribute because it helps with moisture management for the wearer. In any garment appearance, comfort, ease of care and durability are important considerations. Compatibility should also be considered for lined garments [1].

For the reported study, five structural and five performance attributes were chosen to make decision for a lined dress. Structural textile attributes included fiber content (AATCC 20, 2013), yarn type, fabric construction (ASTM D579-01), fabric count (ASTM D3775-12), and fabric weight (ASTM D3776-2013) were selected as structural attributes. Performance attributes represented appearance retention (AATCC 124-2001), dimensional stability (AATCC 96, 2001), horizontal wicking (AATCC 198 2013), pilling resistance (ASTM D 3512-02), and tearing strength ASTM D 2261-96). All tests were performed following instructions from Wroblewski SM [5]. It is important to mention that lining should be slippery to allow easy donning and doffing of the garment. Acetate has been used extensively for lining in the industry. Therefore, acetate was chosen [6].

Findings revealed that fashion fabric was made from 100% cotton, single yarns, light weight, high count, and plain weave. Lining was made from 100% acetate, single yarns, light weight, high count, and plain weave. Except for fiber content, two fabrics were similar for structural attributes (Table 1).

Table 1: Structural textile attributes for cotton fashion fabric and acetate lining.

Structural Attributes	Fashion Fabric	Lining	Compatibility
Fiber Content	Cotton	Acetate	No
Yarn Type	Single	Single	Yes
Fabric Construction	Woven	Woven	Yes
Fabric Count	124x83 = 207	175 x 76=231	
	High	High	Yes
Fabric Weight	2.812ozs/yd^2	2.611ozs/yd^2	
	Light Weight	Light Weight	Yes

Table 2: Performance textile attributes for cotton fashion fabric and acetate lining.

Performance Attributes	Fashion Fabric	Lining	Compatibility
Dimensional Stability (%)	Warp 1.24%	2.78%	Not Compatible
	Weft 0.69%	1.58%	
Appearance Retention	2.56	1.33	Not compatible
Pilling Resistance	5	5	Compatible
Tear Strength (psi)	Warp 7.02	1.05	
	Weft 3.3	1.04	Not compatible

Horizontal Wicking (mm/sec^2)	4.438	32.235	Not Compatible

Table 2 displays results for performance attributes. Results revealed that fabrics were not found to be compatible for performance attributes. Fashion fabric passed for dimensional stability but lining failed (Table 2). Therefore, two could not be used together for a lined garment unless dry cleaned. Both failed appearance retention test. However, ironing could be recommended to overcome this difference. A special care is required because two fabrics do not withstand same temperature level. Acetate could melt at the temperature that cotton yields the best results. Both passed pilling test. Horizontal wicking was much higher for acetate than cotton. Acetate will be next to skin as lining and it is good to have higher wicking for effective moisture management than the fashion fabric. Finally, lining failed the tear strength test, but cotton passed it. Two fabrics may be appropriate choices but results show that lining is weaker than the fashion fabric and will result in compromised durability.

Preceding information reveals that even though two fabrics are structurally compatible, they did not perform well together based on various performance attributes. This another way to determine appropriateness and compatability by comparing findings against the industry standards to assess if fabrics meet or exceed standards. Therefore, technical data sheets were developed for both fashion fabric and lining fabrics. Comparison against the standards reveals that fashion fabric passed three out of five tests and lining passed only one out of five tests. Therefore, these two fabrics were not compatible based on both type of testing.

UCSM designs

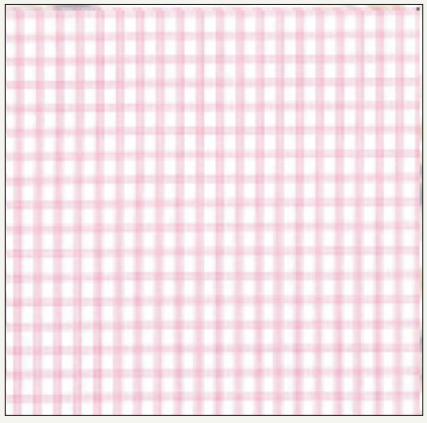

Figure 1: 100% cotton fabric, Price: $5.99/yd.

Table 3: Structural attributes.

Attribute	Finding	Classification
Fiber Content	100% Cotton	Cellulosic
Yarn Type	Untwisting Showed Fibrous Structures	Single Yarn
Fabric Construction	1 x 1 Repeat	Plain Weave
Fabric Count	124 x 83 = 207	High
Fabric Weight	2.812 oz/yd^2	Light

Table 4: Performance attributes.

Attribute	Finding	Standard	Pass/Fail
Dimensional Stability	Warp: 1.24% Weft: 0.69%	2% Max	Pass
Appearance Retention	2.56	3.5 Minimum	Fail
Pilling	5	≥4	Pass
Tear Strength	Warp: 7.02 PSI Weft: 3.30 PSI	2.5 PSI Minimum	Pass
Horizontal Wicking	4.438 $78MM^2/s$	78 MM^2/S Minimum	Fail

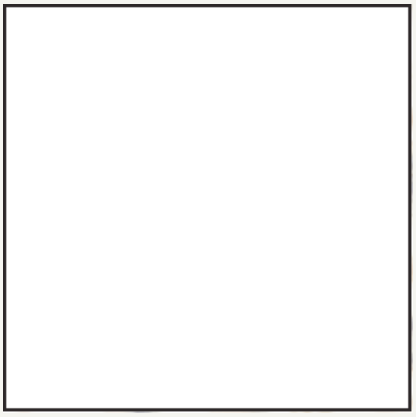

Figure 2: 100% acetate lining, Price: $3.99/yd.

Table 5: Structural attributes.

Attribute	Finding	Classification
Fiber Content	100% Acetate	Manmade Fiber
Yarn Type	Untwisted into Filaments	Single Yarn
Fabric Construction	1 x 1 Repeat	Plain Weave
Fabric Count	175 x 76 = 231	High
Fabric Weight	2.611 oz/yd^2	Light

Table 6: Performance attributes.

Attribute	Finding	Standard	Pass/Fail
Dimensional Stability	Warp: 2.78% Weft: 1.58%	2% Max	Fail
Appearance Retention	1.33 Minimum	3.5 Minimum	Fail
Pilling	5	≥4	Pass

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Tear Strength	Warp: 1.03 PSI Weft: 1.04 PSI	1.5 PSI Minimum	Fail
Horizontal Wicking	32.235	Not Available	Fail

The research study can be duplicated in academic as well as industry settings. This methodology can be used for apparel product development process when making decisions to make final selection for a variety of fabrics and end uses. Using technical data sheets and same tests for all fabrics under consideration can enhance the efficiency of decision-making process. Communication between technical and executive team can be enhanced by using numbers simplistically and effectively [7]. The process can be further enhanced by using statistical testing to add objectivity in the selection process. For the reported study, t-values were computed to compare fashion fabric and lining for appearance retention and horizontal wicking. Results revealed that two fabrics differed significantly for these performance attributes and reinforced their non-compatibility. For the reported study, classification for fiber content was labeled as not applicable. If necessary, they could be labeled as cellulosic for the fashion fabric and regenerated for acetate. Depending on the end-uses, other structural and performance attributes could be chosen.

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