Case Study of Durability, Abrasion Resistance, and Colorfastness to Crocking and Frosting on Faux Leather Fabrics

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Introduction. Genuine leather produces a heavily polluting substance, due to the use of harmful chemicals in the tanning and finishing process (Jung et al., 2014; Kim et al., 2016). Therefore, many fashion designers and brands are more apt to use faux leathers because faux leather is a better alternative of genuine leather for environmental concerns and animal rights (Mohamed & Hassan, 2015; Kim et al., 2016). Although faux leather is non-biodegradable and produces toxic gas when burning, development of eco-friendly faux leather made of bio-based polyurethane and nanocellulose could minimize environmental concerns (Kim et al., 2016).

Faux leather can be made by coating a layer of polyurethane (PU) embossed onto the surface of a fabric. Polyurethane has good adhesion to the fabric, durability at low temperature, softness, viscosity, abrasion resistance, resistance to oils, cleaning resistance, and wash proof (Wentao et al., 2010). Faux leather looks and feels like genuine leather, but genuine leather is more durable, water vapor permeable, and hydrophilic. According to Mohamed and Hassan's study (2015), faux leather is less abrasion resistant and breathable, but more colorfast to light than genuine leather. As faux leather fabrics are increasingly used, more extensive research on faux leathers is needed to better understand durability and abrasion resistance aspects of faux leathers that influence performance of apparel products. Thus, the purpose of this study was to examine faux leather's durability, abrasion resistance, and colorfastness related to various abrasions, surface contact, and rubbing. This study focused on testing faux leather fabrics' abrasion resistance-related issues because faux leathers with coatings may have more potential problems, due to surface abrasion.

Methods. Two different types of faux leather fabrics were used as a sample in this study: 1) faux leather fabric with PU coating (base: 100% polyester, coated: 100% polyurethane), 2) textured faux leather fabric without PU coating (100% polyester). The two faux leather fabrics were tested using ASTM and AATCC standard test methods. The faux leather's weight was 4.72 oz/yd^2 and classified as a medium weight fabric; the textured faux leather's weight was 4.2 oz/yd^2 and classified as a lightweight fabric. The faux leather fabric with PU coating had a softer touch and stretch, while the textured faux leather fabric had a hard textured surface with little softness and stretch.

Results. ASTM D 4232 Standard Performance Specification for Men's and Women's Dress and Vocational Career Apparel Fabrics was used to determine the specification requirements for apparel products. Regarding ASTM D 1424, the faux leather fabric's tearing strength was 4.02 lbf (warp) and 7.80 lbf (filling), and met the minimum specifications of 3.5 lbf

for medium weight fabric. The textured faux leather fabric's tearing strength was 3.19 lbf (warp) and 3.38 lbf (filling), and met the minimum specification of 2.5 lbf for lightweight fabric.
For ASTM D 5034, the faux leather fabric's breaking strength was 66.3 lbf (warp) and 23 lbf (filling), where the minimum specification is 40 lbf for medium weight fabric. The textured faux leather fabric's breaking strength was 14.65 lbf (warp) and 11.35 lbf (filling), and failed to meet the minimum specifications of 35 lbf for lightweight fabric. For ASTM D 3886, both fabrics did not have a hole or broken threads even after 3,000 cycles and met the minimum specification of 3,000 cycles, indicating good flat abrasion resistance. But, the surface coatings on both fabrics were significantly peeled, indicating severe visual changes, due to repeated flat abrasion. For ASTM D 3885, the faux leather fabric did not have a rupture after 1,000 cycles and met the minimum specification, indicating good flex abrasion resistance. However, the textured faux leather fabric ruptured at average 499 (warp) and 479 (filling) cycles, indicating poor flex abrasion resistance. For AATCC 93, the faux leather fabric had 4.90% weight loss and the textured faux leather fabric had 5.78% weight loss. Both fabrics did not meet the minimum specification of 3% weight loss, indicating poor resistance against multi-directional abrasion. For ASTM D3512, both fabrics were Class 5 and met the minimum specification of Class 4, indicating good pilling resistance. For ASTM D 3939, the faux leather fabric had Class 1.5 for warp and Class 2 for filling; whereas, the textured faux leather fabric had Class 3 for warp and Class 3.5 for filling. Both fabrics did not meet the minimum specification of Class 4, indicating poor snagging resistance on the surface. For AATCC 8, the faux leather fabric had Class 5 for dry test and Class 4 for wet test, and met the minimum specification, indicating good colorfastness to crocking. However, the textured faux leather fabric had Class 3.25 for dry test and Class 2 for wet test and failed to meet the minimum specification of Class 4 for dry test and Class 3 for wet test. For AATCC 119, the faux leather fabric had an average Class 5, indicating little color change, due to flat abrasion (frosting) and good colorfastness to frosting. However, the textured faux leather fabric showed an average Class 2 and did not meet the minimum specification for Class 4.

Discussion. The faux leather fabric with PU coating exceeded almost all product specifications except for breaking strength in filling direction, multi-directional abrasion resistance, and snagging resistance. However, the textured faux leather fabric failed to meet almost of all of the product specifications except for tearing strength, flat abrasion resistance, and snagging resistance. Results show the faux leather fabric with PU coating was durable and abrasion resistant against flat and flex abrasions, and pilling; also had good colorfastness to surface contact and rubbing (crocking) and flat abrasion (frosting). The textured faux leather fabric was resistant against flex abrasion and pilling only. Both fabrics had severe visual changes after flat abrasion because of coated surface peeling, weight loss due to multi-directional abrasion, and severe surface changes due to snagging. Results from this study provided academic researchers and consumers with more detailed information about faux leather fabrics' durability, abrasion resistance, and colorfastness aspects in relation to types of coatings, various abrasions, surface contact, rubbing, pilling, and snagging. The different results between the two faux leather fabrics need more investigation as to what makes a faux leather superior to another faux leather.

References

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