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Investigation of the basic properties of car seat fabrics applied in automotive textiles

Abstract

The aim of this paper is to investigate the basic properties of car seat fabrics applied in automotive textiles. Three types of textile materials namely velvet, flock and flat woven fabrics were used in this research for investigation. These three types of fabrics are available in private cars and also cost effective in local market. Polyester fabrics were used as base fabric along with all these velvet, flock and flat woven fabrics. Polyester fabrics are stronger those provide strength to the seat fabrics where velvet and flock fabrics provide comfort to the passengers. These textile fibers have also very good comfort properties. Different types of experiments namely fiber identification, strength test, color fastness test, abrasion resistant test and bending test were carried out in accordance with the test method provided by ISO standard. Microscopic views were also taken for assessment. Color fastness properties were also investigated to know the best color values. Grey scale test method for color property testing was used for all types of color fastness tests. This research is practice based and the findings are important for the personnel employed in automotive industries and to controlling of their properties. Further research can be conducted and commercial production may be beneficial by virtue of this research.

Keywords: seat fabrics, automotive textiles, velvet fabrics, flock fabrics, flat woven fabrics, fiber identification, fabric structure, tear strength, tensile strength, fabric's stiffness

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Introduction

There is a great importance of this paper in the field of automotive textiles. This research shows the benchmark of car seat fabric's properties for commercial manufacturing. The seat needs to deliver the body with care under all road situations comprising cornering, accelerating and braking. The abrasion properties of cloths depend to a convinced extent on structure and the type of yarn, grade of texture, fineness of filaments and also very meaningfully on the fiber type.[1] Acrylic has the maximum light and UV confrontation but falls down on scratch compared to the other synthetic Fiber. Figure 1 shows Car Seat Fabrics.[2]

Figure 1 Car seat fabrics.

The substance which has risen to importance during the 1970s and 1980s and is now applied in over 75% of all vehicle seats world-wide is polyester.[3] The outstanding UV resistance resistance of polyester collective with very good abrasion confrontation and relatively cheap price safeguard that it will keep its protruding position among the obtainable fiber.[4] Other possessions of polyester which brand it perfect for car seat shelters include, high tear strength, resistance to mold, low water porosity, letting it to be kept clean effortlessly, outstanding resilience and crease confrontation.[5] The last property is helped by lamination to polyurethane foam.

Polypropylene fiber is less exclusive than polyester, is demanded to be more effortlessly recycled and is meaningfully lighter in weight.[6] Though, at present its difficulties out-weight the advantages.[7] The most thoughtful problematic is that it cannot be dyed industrially in a dye bath, and the only commercially available tinted polypropylene yarns have been turned dyed during production.[8,9]

Materials and methods

Velvet fabric

Velvet fabric is a type of warp cut pile fabric. Base fabric can be used as plain or twill to construct such fabrics. Figure 2 shows Velvet Fabrics.[10]

Figure 2 Velvet fabric.

Flock fabric

Flock fibers are applied with adhesive to produce a decorative pattern. These types of fabrics are used as car seat fabrics. Base fabrics are made of yarn containing polyester fibers.[11] Figure 3 shows Flock Fabrics.

Figure 3 Flock fabric.

Flat woven fabric

Flat woven fabric was used as car seat fabrics.[12] Figure 4 shows a flat woven fabric. These fabrics have several layers that offer high strength. These cloths are accessible in light weight for packing of textiles and creating seat covers and in dense weight for substantial wrapping. It delivers whole defense to substances from contrary situations.

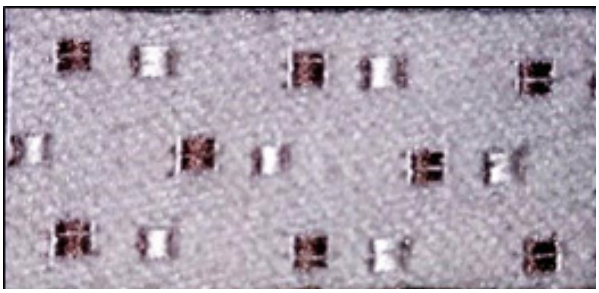

Figure 4 Flat woven fabric.

The experimentation

An optical microscope was used for fiber identification. Each fiber has certain look and characteristics in microscopic instrument. All the fibers were checked by microscope to be confirmed their fiber types.[13]

In accordance with the test method ISO 13937, the tear test was conducted out. The device contains of a pendulum resonant a clamp which is in arrangement with a fixed clamp when the weight is in the elevated, preliminary position with maximum probable energy.[14] The sample is attached in the clamps and the tear is ongoing by cutting a split in the sample between the holds.[15] Tensile tests were also carried out to know the tensile properties of the seat fabrics.

According to ISO 12945, the abrasion test was conducted. A circular test sample is conceded over a rubbing surface including the same cloth, when pertinent, a wool abrading fabric, at a distinct force, with the test sample able to swap easily about an axis through its midpoint, vertical to the plane of the test sample.[16]

According to ISO 9073, bending test was carried out. A quadrilateral band of fabric is reinforced on a flat podium with the long axis of the strip similar to the long axis of the stage.[17] The band is progressive in the way of its length so that a growing part projections the stage and turns down under its individual mass.[18] The drooping is free at the end and secure at the other from the weight practical by a slide on the share of the test residence still on the stage.

According to ISO 105, wash fastness test was conducted. A sample of the textile in interaction with stated head-to-head fabric is washed, rinsed and dried. Samples are washed under suitable circumstances of temperature, alkalinity, bleaching and coarse action such that the consequence is got in a suitably short time.[19] The rough action is talented by the use of a low liquid ratio and a suitable number of steel spheres. The alteration in colour of the sample and the stain of the together fabric is measured by contrast with the grey scales.[20]

According to ISO 105, rubbing test was carried out. Samples of the textile are scrubbed with a dry impression material and with a wet impression cloth. The mechanism delivers two mixtures of testing situations through two another sizes of impression finger: one for pile cloths and one for solid color.[21]

According to ISO 105-B02, light fastness test was conducted. A sample of the textile is visible to fake light under skillful circumstances, composed with a set of orientation materials. The color retreat is measured by associating the change in color of the test sample with that of the orientation resources used.[22]

According to ISO 105-E04, perspiration fastness test was carried out. Some sample of fabrics are treated in two dissimilar solutions covering histamine, drained and placed amid two plates under a stated weight in a test expedient.[23] The examples and the adjacent cloths are dried disjointedly. The variation in color of each sample and the bruising of the together fabrics are measured by contrast with the grey measures.

For conducting the stiffness texts, Shirley Stiffness Tester was used. It is one of the main features to justice the bending rigidity and the cloth handling properties. Stiffness values and handling properties are the vital issues for the customers. The extent of clothes stiffness values are connected to its properties like as flexibility, elasticity and texture.

Result and discussion

Fiber identification

Using light microscope, fibers were identified. Each fiber has some specific views in microscope. Microscopic views exposed some rod like shapes persist in polyester fibers. Figure 5 shows Polyester Fiber Microscopic Views.

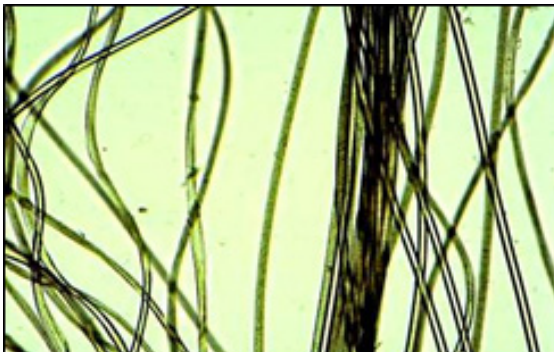

Figure 5 Polyester fiber microscopic view.

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Fabric structure

Microscope was applied to see the face side and back side of fabrics. The face side and back side of velvet fabrics were assessed using a light microscope. Figure 6 and Figure 7 shows the face side and back side of velvet fabrics. Figure 8 and Figure 9 shows the face side and back side of flat woven fabrics. Figure 10 and Figure 11 shows the face side and back side of flock fabrics.

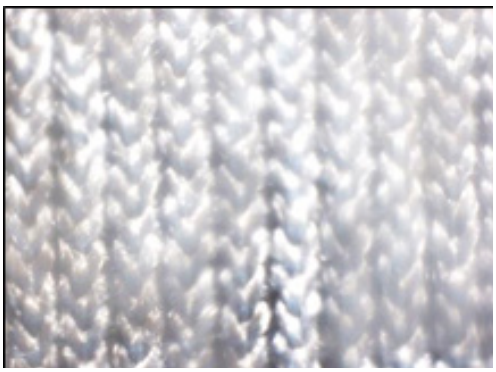

Figure 6 Velvet fabric back side.

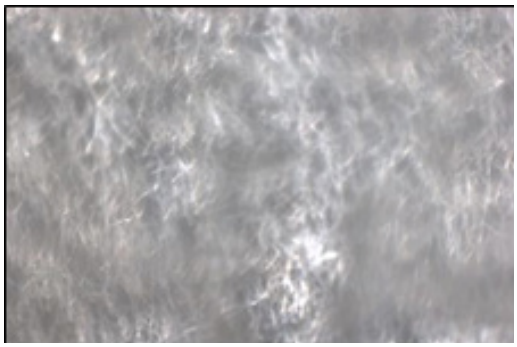

Figure 7 Velvet fabric face side.

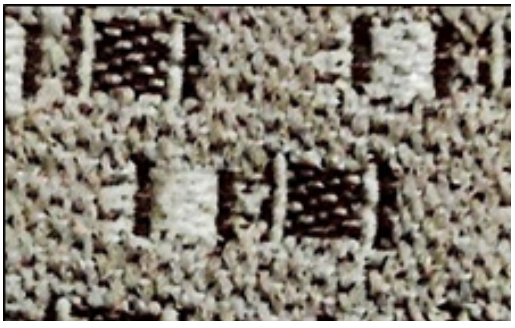

Figure 8 Flat woven fabric back side.

Thickness

Shirley thickness gauge was applied to decide the thickness of the fabrics. Table 1 shows the thickness of different fabrics. It is seen from the figure that, the lowest thickness were achieved for flock fabrics 0.9mm and the highest thickness were achieved for velvet fabrics 2.9mm.

Fabric weight (gm/m^2)

A round GSM cutter was used to check the weight of the fabrics. Table 2 shows the weight of different fabrics. It is seen from the figure that, the least weight were achieved for flock fabrics 190gm/m^2 and the highest weight were achieved for velvet fabrics 390gm/m^2.

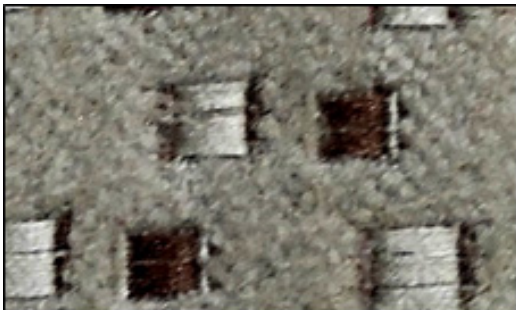

Figure 9 Flat woven fabric face side.

Figure 10 Flock fabric back side.

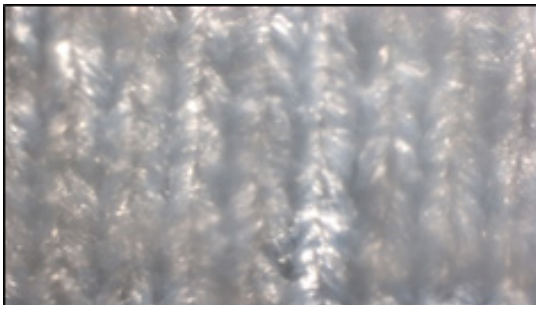

Figure 11 Flock fabric face side.

Table 1 Color fastness values of the different fabrics

Different fabrics	Thickness (mm)
Velvet	2.9
Flock	0.9
Flat woven	2.2

Table 2 Weight of different fabrics

Different fabrics	Weight (gm/sq.mtr)
Velvet	390
Flock	190
Flat woven	320

Tensile test

Strength is an important property of car seat fabrics. Tensile strength was investigated using Textile Tensile Testing Machine TF002 of Testex Company. Table 3 shows the tensile testing report.

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The highest values were obtained for the fabrics of flat woven 420N and the lowest values were obtained for the fabrics of velvet 310N. The values of warp and weft direction both were investigated.

Table 3 Tensile strength of different fabrics

Different fabrics	Tensile (N)
Velvet (warp)	310
Velvet (weft)	190
Flock (warp)	360
Flock (weft)	180
Flat woven (warp)	420
Flat woven (weft)	250

Tear strength

Tear strength was investigated using Textile Tear Testing Machine TF142A of Testex Company. Table 4 shows the tear testing report. The highest values were obtained for the fabrics of flat woven 46N and the lowest values were obtained for the fabrics of velvet 32N. The values of warp and weft direction both were investigated.

Table 4 Tear strength of different fabrics

Different fabrics	Tear (N)
Velvet (warp)	32
Velvet (weft)	16
Flock (warp)	36
Flock (weft)	19
Flat woven (warp)	46
Flat woven (weft)	24

Stiffness test

The end and the pick strips of the fabrics are sustained at the vital quantity and turn under its specific load. The warp and weft manages the bending strips amount so that the drape approaches can be identified. It is seen from the Table 5 that, the flat woven fabrics have the best stiffness values 3.73cm where the least values were obtained for flock fabrics 2.35cm.

Table 5 Stiffness values of different fabrics

Different fabrics	Bending length (cm)
Velvet (warp)	2.9
Velvet (weft)	3.05
Flat woven (warp)	3.39
Flat woven (weft)	3.73
Flock (warp)	2.4
Flock (weft)	2.35

Color fastness test

Colorfastness values were investigated of all types of fabrics used in car seat fabrics applied in this research. Best color fastness values promise the best color durability. It is seen from Table 6 that, the best color fastness properties were obtained for the flat woven fabrics and the worst color fastness properties was obtained for flock fabrics.

Table 6 Color fastness values of the different fabrics

Different fabrics	Light fastness	Wash fastness	Rubbing fastness		Perspiration fastness	
			Dry	Wet	Acidic	Alkaline
Flat woven	4	3-4	2-3	3-4	3-4	4
Velvet	3-4	3	2-3	3	3	3-4
Flock	2-3	2-3	3	2-3	3	3

Conclusion

It is seen throughout the research that, all the basic properties of car seat fabrics were investigated and their results were subsequently analyzed. The best color properties were obtained for flat woven fabrics and the worst color fastness properties were obtained for flock fabrics. Both tear and tensile strength properties were investigated in both warp and weft direction of these woven fabrics. The best strength properties were investigated on flat woven fabrics and the worst strength properties were investigated on velvet fabrics. The thickness values were also obtained and velvet had the best values. The thicker fabrics provide best comfort properties of car seat fabrics. This research is practical oriented and has good impact value for automotive industries.

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Conflicts of interest

The authors report no declarations of interest.

References

1. Islam S, Alam SMM, Ahmed S. Attaining optimum values of colourfastness properties of sustainable dyes on cotton fabrics. *Fibres & Textiles in Eastern Europe*. 2020;28(6):110–117.
2. Islam S, Alam SMM, Akter S. Investigation of the color fastness properties of natural dyes on cotton fabrics. *Fibers and Textiles*. 2020;27(1).
3. Islam S, Alam SMM, Akter S. Identifying the values of whiteness index, strength and weight of cotton spandex woven fabric in peroxide bleaching of different concentration. *Fibers and Textiles*. 2019;26(4):96–109.
4. Islam S, Alam SMM, Akter S. Influence of thermal conduction on the stretching behavior of core spandex cellulosic fabrics. *Materials Today: Proceedings*. 2021;38:2563–2571.
5. Islam S, Alam SMM, Akter S. Identifying the amount of heat flux and thermal conduction through fabrics with appropriate heat equation. *Computational Engineering and Physical Modeling*. 2021;4(2):53–67.
6. Islam S, Alam SMM, Akter S. Mathematical investigation of the thermal conductivity of fabrics using thermal equation. *Materials Today: Proceedings*. 2020.
7. Islam S. Attaining optimum strength of cotton-spandex woven fabric by apposite heat-setting temperature. *Journal of The Institution of Engineers (India): Series C*. 2019;100(4):601–606.

8. Islam S, Alam SMM, Akter S. Identifying a suitable heat setting temperature to optimize the elastic performances of cotton spandex woven fabric. *Research Journal of Textile and Apparel*. 2018.

9. Ainum Najwa. Types and features of polyester fabric. features of polyester fabric. 2008.

10. Islam S, Alam SMM, Akter S. The consequences of temperature on the shrinkage properties of cotton spandex woven fabric. *Journal of Textiles and Polymers*. 2019;7(1):2–7.

11. Islam S, Md H, Md A, et al. Identifying the Causes of the Spandex Breakage of Woven Garments and its Solutions. *Adv Res Text Eng*. 2020;5(1):1042.

12. Islam S, Ahmed MS, Arifuzzaman AKMS, et al. Relationship in between strength and polyester content percentage of cotton polyester blended woven fabrics. *Int J Clothing Sci*. 2019;6(1):1–6.

13. Alam SMM, Islam S. Implement of predrying to enhance productivity of existing stenter in knit finishing industry. *Biomedical Journal of Scientific & Technical Research.* 2020;29(5):22809–22811.

14. Islam S, Alam SMM. Investigation of the acoustic properties of needle punched nonwoven produced of blend with sustainable fibers. *International Journal of Clothing Science and Technology*. 2018.

15. El Messiry M. Green Composite as an Adequate Material for Automotive Applications. Singapore: Green Composites Springer; 2021:151–208.

16. Cai Z, Al Faruque MA, Kiziltas A, et al. Sustainable lightweight insulation materials from textile-based waste for the automobile industry. *Materials*. 2021;14(5):1241.

17. Ahirwar M, Behera BK. A mathematical model for objective hand evaluation of automotive seat fabrics. *Journal of Industrial Textiles*. 2020.

18. Siyao M, Liu S, Peihua Z, et al. Functional investigation on automotive interior materials based on variable knitted structural parameters. *Polymers*. 2020;12(11):2455.

19. Cai Z, Al Faruque MA, Kiziltas A, et al. Sustainable lightweight insulation materials from textile-based waste for the automobile industry. *Materials*. 2021;14(5):1241.

20. Kovačević S, Domjanić J. Effects of layer thickness and thermal bonding on car seat cover development. *Fibres & Textiles in Eastern Europe*. 2017.

21. Fazita MN, Nurnadia MJ, Khalil HA, et al. Woven natural fiber fabric reinforced biodegradable composite: processing, properties and application. Green Biocomposites. Springer, Cham; 2017:199–224.

22. Akgun M, Becerir B, Alpay HR, et al. Investigation of the effect of yarn locations on color properties of polyester automotive upholstery woven fabrics after abrasion. *Textile Research Journal*. 2010;80(14):1422–1431.

23. Dastjerdi R, Mojtahedi MRM, Shoshtari AM, et al. Investigating the production and properties of Ag/TiO2/PP antibacterial nanocomposite filament yarns. *The Journal of The Textile Institute*. 2010;101(3):204–213.

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