The effect of material type, yarn count, and treatment with water-repellent materials on some of the natural and mechanical properties of car cover fabrics

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Abstract:

Car covers are considered basic for the preservation of cars from various weather factors such as rain, dust, sun and others. So, we use the next raw materials for warp (cotton 100%) and yarn count 16/1 and different types of weft materials (cotton 100%, blended cotton / polyester 50:50%, polyester 100%) and yarn count (12/1, 16/1, 20/1) and the use of the weave structure 3/1Twill. laboratory tests were done for the samples produced (water permeability, tensile strength and elongation). The research problem is summarized by the fact that some of the currently existing car cover fabrics are permeable to rain water, which leads to the damage of the car's body and the coatings on it, hence there is the need to produce high-strength car covers that bear the changing weather factors. The research objectives are also summarized in the production of car cover fabrics that provide protection, in terms of its resistance to water penetration, and studying the effect of different structural factors on the water permeability properties of car cover fabrics, and get access to the best samples of car covers, the research has reached:

• Samples produced from warp cotton and weft polyester are the best samples in terms of tensile strength and elongation, followed by warp cotton and weft cotton/polyester blended 50:50%, then warp cotton and weft cotton samples.

• For water permeability, the cover equipped with warp cotton and weft polyester is the best water-resistant samples, followed by warp cotton and weft cotton /polyester blends 50:50%, followed by warp cotton and weft cotton samples.

• The raw fabric has very low water permeability resistance.

• The best wefts in terms of tensile strength, elongation and water permeability are 12/1, followed by 16/1, followed by 20/1.

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Research Problem:

1. Some existing car cover fabrics are permeable to rain water, which leads to damage of the car body and its coatings.
2. The need to produce high-durability car covers that withstand changing weather conditions and achieve the highest possible service life span.

What is the effect of the type of material, thread tiger, and treatment with water-repellent materials on some of the natural and mechanical properties of car cover fabrics?

Research Aims:

1- The production of auto cover fabrics that provide protection in terms of their resistance to water penetration.
2- Study the effect of different structural factors on the water permeability properties of car cover fabrics.
3- Access to the best samples of car covers.

Research Importance:

Contribute to the production of high-quality automobile cover fabrics, and achieve efficient functionality in terms of being waterproof to the car's body and having high durability, while reducing its economic cost.

Methodology:

The research follows the experimental analytical method.

Research Variables:

1- Raw materials used in the production of car covers:
warp: 100% cotton, weft: (100% cotton, 100% polyester, 50% cotton / polyester: 50%)
2- Use the weave structure of 3/1 Twill.
3- The warp density is 36 feet / cm, and the wefts density is 22 ends / cm.
4- Yarn count used: warp (1/16), weft (1/12, 1/16, 20/1).
5- Equipping with fluorocarbon to resist water permeability.
6- Conducting tests to measure tensile strength, elongation and water resistance.

Experimental Work:

Table (1) Specification of the machine used for producing samples

Fabric item number	1650
The name of the machine	Nova Benoni, Italy
Machine model	2/5200 TP
Year of manufacture	1988
Machine speed	313 ppm
The width of the canvas	162 cm
The width of the comb	167.5 cm
The number of doors in the poison	9 doors / cm
The number of screws in the door	4 threaded / door

Table (2) practical experiments:

The sample code	the type of warp material	the type of weft material	the number of wefts
A1	100% cotton Yarn count 1/16	100% cotton	12/1
A2		50% polyester / cotton blend	
A3		100% polyester	
A4		100% cotton	16/1
A5		50% polyester / cotton blend	
A6		100% polyester	
A7		100% cotton	20/1
A8		50% polyester / cotton blend	
A9		100% polyester	

Lab tests:

The tests were carried out at the National Research Center, Division of Weaving Research.

1- Water permeability resistance test:

• The test was performed according to AATCC 35.

This device is used to measure the average vertical water permeability of different fabrics.

2- Tensile strength and elongation test:

The test was carried out according to ASTM D 5035.

• The test was conducted with the Asano Machine.

Table (3) The specification of all samples

The sample code	The type of warp material and its type	The type of weft material	The number of wefts	Type of processing	Water permeability (l / m^2s)	Tensile strength (kg / cm)	Elongation %
A1		100% cotton	12/1	Before processing	0.546	69.3	15.6
A2		50% polyester / cotton blend			0.640	93.3	19.6
A3		100% polyester			0.873	120	25.3
A4		100% cotton	16/1		0.596	41.6	16.3
A5		50% polyester / cotton blend			0.654	69.6	20.6

A6	100 % cotton Yarn count 1/16	100% polyester	20/1		0.864	81	23.3
A7		100% cotton			0.653	35.3	16.3
A8		50% polyester / cotton blend			0.744	42.6	21.6
A9		100% polyester			0.909	93.6	24
B1		100% cotton	12/1	After processing	0.256	56.3	19.6
B2		50% polyester / cotton blend			0.266	69	23.6
B3		100% polyester			0.212	104.3	25
B4		100% cotton	16/1		0.421	41	18.6
B5		50% polyester / cotton blend			0.350	53.3	21
B6		100% polyester			0.260	80	27.3
B7		100% cotton	20/1		0.348	31	15.3
B8		50% polyester / cotton blend			0.308	41.6	24.3
B9		100% polyester			0.230	65	23.6

Results and Discussions:

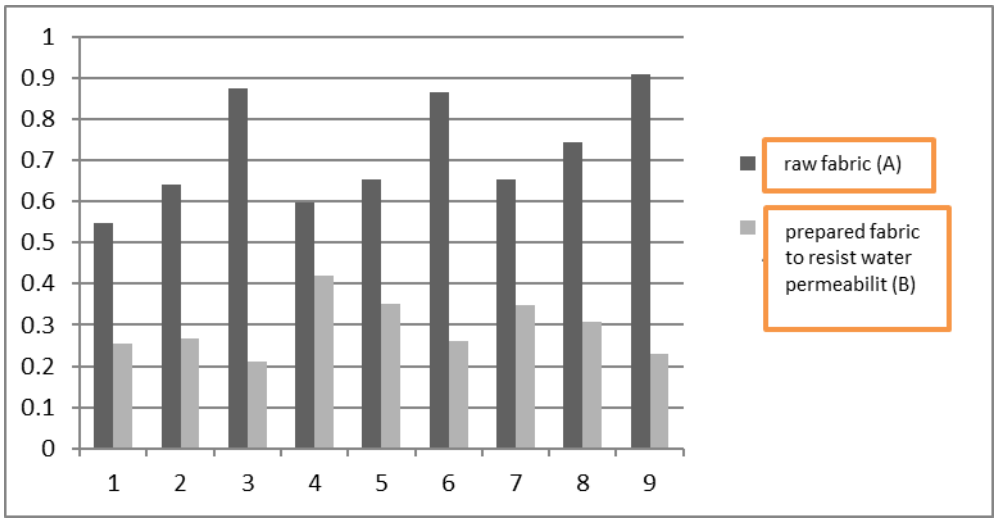

Figure (1) shows the water permeability test on raw and prepared fabrics to resist water permeability

It can be seen from Table (3) and the diagram (Figure 1):

1- The prepared fabric is more water-repellent than the raw one.

2- The raw sample (A1) with warp material is 100% cotton with 1/16 yarn count and the weft material is 100% cotton with 1/12 yarn count water permeability. It was the best sample because it is the lowest sample in terms of water permeability, because cotton is the highest of raw materials in water absorption, so it is the least of raw materials in terms of permeability, and the thicker weft count works to reduce the intersections between the threads and increase the coefficient of coverage, thus reducing the permeability. As for the raw sample (A9), with the warp material, 100% cotton, 1/16 yarn count, and the weft material is 100% polyester with 1/20yarn count water permeability. The highest sample in terms of permeability is 0.909. This is due to the properties of polyester that does not absorb water, so it is the highest of the raw materials in terms of water permeability. Also, the thin weft count reduces the coefficient of filament coverage and thus increases the permeability.

3- That the sample (B3) equipped to resist water permeability with the warp material 100% cotton with a number 1/16 yarn count and the weft material is 100% polyester with a number 1/12 yarn count with a water permeability of 0.212 is the best sample because it is the lowest sample in terms of water permeability, and the thicker weft count works on Reducing the interfacial distances between the threads and increasing the coverage coefficient, thus reducing the permeability. As for the sample (B4) equipped to resist water permeability, the warp material is 100% cotton with a number 1/16 yarn count and the weft material is 100% cotton with a number 1/16 yarn count with a water permeability of 0.421. The highest sample in terms of permeability.

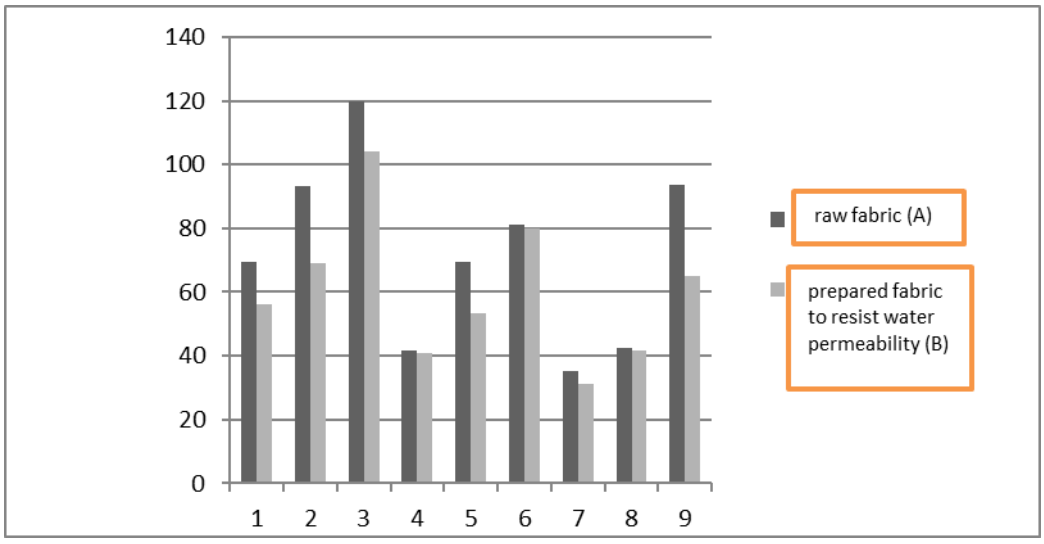

Figure (2) shows the tensile strength test on raw and prepared fabrics to resist water permeability

As can be seen from table (3) and the diagram (Figure 2):

1- Processed fabrics have lower tensile strength than raw fabrics.

2- The raw sample (A3) with the warp material is 100% cotton with a number of 1/16 yarn count and the weft material is 100% polyester with a number of 1/12 yarn count with a tensile strength of 120 kg / cm. The best sample is this sample because it is the highest in tensile strength due to the properties of polyester with high tensile strength. Also, the thicker weft count

increases the tensile strength. As for the raw sample (A7) with the warp material 100% cotton with a number of 1/16 yarn count and the weft material is 100% cotton with the number 1/20 yarn count with the tensile strength of 35.3 kg / cm, the lowest sample in the tensile strength due to the low tensile strength of the cotton. The high works to lower the tensile strength.

3- That the sample (B3) is equipped to resist water permeability with the warp material is 100% cotton with a number of 1/16 yarn count and the weft material is 100% polyester with a number 1/12 yarn count with a tensile strength of 104.3 kg / cm. it is the best sample because it is the highest sample in tensile strength due to the properties of polyester with high tensile strength, and thicker weft tones increase the tensile strength, but it is less than the raw fabric because the processing affects the tensile strength. As for the sample (B7) equipped to resist water permeability, the warp material is 100% cotton, with a number of 1/16 yarn count, and the weft material is 100% cotton with a number 1/20 yarn count with the tensile strength of 31 kg / cm, the lowest sample in the tensile strength due to the low tensile strength of the cotton. The thin weft lowers the tensile strength, but it is less than the raw fabric because the processing affects the tensile strength.

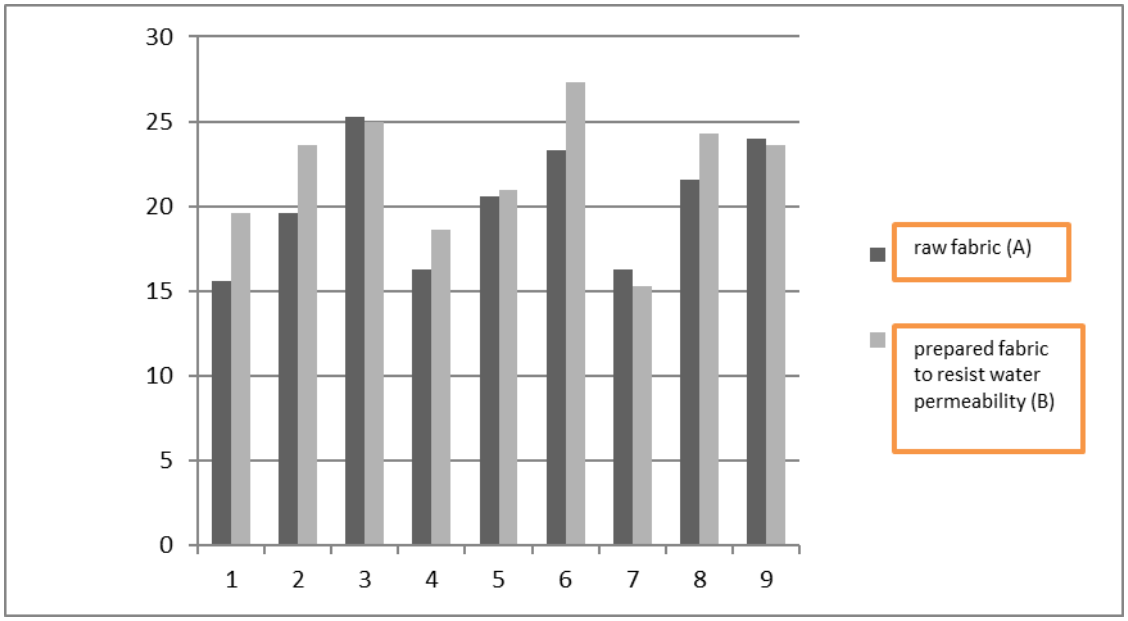

Figure (3) shows the weft elongation test on raw and prepared fabrics to resist water permeability

As can be seen from Table (3) and the diagram (Figure 3):

1- Most of the prepared samples are more elongated than the raw samples.

2- The raw sample (A3) with the warp material is 100% cotton with a number of 1/16 yarn count and the weft material is 100% polyester with a number of 1/12 yarn count with a weft elongation of 25.3%, it is the best sample because it is the highest in weft elongation and due to the high elongation properties of the polyester. Also, the sample (A1) with warp material is 100% cotton by number 1/16 yarn count, and the weft material is 100% cotton by number 1/12 yarn count with a weft elongation of 15.6%, the lowest sample in weft elongation is due to the properties of cotton of low elongation.

3- That the sample (B6) equipped to resist water permeability with the warp material is 100% cotton with a number of 1/16 yarn count and the weft material is 100% polyester with a number of 1/16 yarn count and has a weft elongation of 27.3%. It is the best sample because it is the highest sample in weft elongation and this is due to the properties of polyester with high

elongation. It is higher than the raw cloth because the finishing increases the elongation of the fabric. The sample (B7) with the warp material is 100% cotton with 1/16 yarn count and the weft material is 100% cotton with a yarn count 20/1 with a weft elongation of 15.3%. The lowest sample in weft elongation is due to the properties of cotton with lower elongation but higher than the raw cloth because the processing works to increase the elongation of the canvas.

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