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Enhancing The Functional Performance Properties Of Pile Weft Knitted Fabrics Used In Car Interiors

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ABSTRACT
Textile advances in the automotive industry have been spearheaded by advances in science and technology of fibers and fabric/web forming technologies. The design, aesthetics, feel and comfort are important considerations for automotive textiles. The major development of recent years has been in the circular-knitted pile fabrics. It's offer quite luxurious pile, variations in texturing processes to create high/low surface effects and luster variants. The main purpose of this study is to reach the best methods of controlling circular pile weft knitting machines adjustment for Cut terry/velour & Fur structures by using different types of raw materials and study the effect of each parameters on the quality and the functional performance properties of produced fabrics which used in car seats and luxuries inside the vehicle to achieve the required characteristics and quality specification. Different fabric structures (8 Terry/velour & 11 Fur) with various constructions parameters were made. Results of testing of these fabrics are illustrated and discussed in order to optimize the car interiors fabrics design. In this paper, the performance properties and various factors affecting it are discussed for car interiors fabrics using different weft pile constructions.
Keywords; Automotive Textiles, circular pile machines, Cut terry/velour Fabrics, Fur Structures, Performance Characteristics.

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I. INTRODUCTION

Automotive textile is that part of textile which is used in accordance with the vehicles i.e., it is widely used in automotive industry right from light weight vehicles to a heavy truck or duty vehicles[1]. Approximately 50 square yards of textile material is used in an average car for interior trim (seating areas headliners, side panels, carpets and trunk, lining, tires, filters, belts hoses, airbags etc.). Hence, the term automobile textile means all type of textile components e.g. fibers, filaments, yarns and the fabric used in automobiles [2].

Fiber is used for several kinds of parts in automobiles such as (a) tyres, driving belts, tubes and hoses, seat belts, air bags, seats, roof trims, floor coverings, noise control materials and cover sheets, (b) filters, and (c) mechanical parts, exterior body panels and bumper beams [3]. In the near future, optical fiber for the information and driving control system, and reinforcing fiber for the fuel pressure vessel may also be widely used. Polyester and polyamide fibers for automotive use in terms of fiber performance requirements [4].

The possibilities offered to the designer of the interior have been referred to earlier and a more detailed study of the various technologies, but it is probably appropriate to consider what they offer in terms of design potential both to the textile designer and the automotive stylist. The major development of recent years has been in the circular-knitted pile fabrics. It's offer quite luxurious pile, variations in texturing processes to create high/low surface effects and luster variants [5]. Knitted pile fabric may be produced by circular weft knitting machine or flat warp knitting machine, the essential difference between a plush and pile structure is that the pile normally composed of a different type of yarn, should stand out almost at right angles from the knitted ground surface. Both plush and the pile surface may consist of either cut or uncut loops of yarn , and in the case of high pile , slivers of fibers instead of yarns are used [6].

The Cut Terry/velour machine is general equipped with the single cam track on the dial and cylinder, smooth cam surfaces, two yarn feeding carrier system in loop and ground stitches are all suitable for the high pile structure in knit processing. The high quality of the machine's frame helps to reach the heavy loading in fabric rolls [7]. The machine produces double jersey knitting structure with sinker knife and press plate in horizontal movement. The cutter on the cylinder forms the loop and the dial needles make the ground fabrics. By sinker knife acting, the loops are able to be cut very evenly on the fabric. The principle of the sinker knife operation which can be effective in reaching the result of cost down in comparison to the needle knife used on the pile cutting models. Moreover, Machine's higher feeder number function has the best advantage as compared to the current low feeder and low productivity pile cutting system [8].

Unlike Velour fabric, Fur fabric is characterized by a longer pile on the fabric surface. It is made on special circular knitting machines in which the surface fibers imitating fur are attached to the fabric, by means of knitting sliver along with base yarn making the fabric. Sliver knit fabrics have longer and denser piles on the fabric surface than other pile jerseys. Animal printed sliver knit fabrics are popularly used as imitation fur fabrics. They are more popular than fur as they are light, more stretchable and do not require special care for storage [9]. The Fur machine can knit various hair lengths fabric and the hair length is determined between the sinker base surface and the bottom surface of dial knife needle [10].

II. MATERIALS AND METHODS

Regarding to theoretical modeling, it is assumed that various fabric structures demonstrate different mechanical and functional properties. This matter is base of sample preparation and plan of experiments. Nineteen weft knitted pile samples were produced using two different structures (Cut terry/velour and Fur) with various materials (cotton , polyester, spun polyester, flat polyester and microfibers).

2.1. Terry/velour Fabrics

As shown in Figure (1), Terry/velour fabric made of Jersey ground knit and additional set of yarns that made the pile loops on the fabric surface.

Despite the technological progress in the field of production of weft knitting pile fabrics which used for car seats, doors and other luxuries inside the vehicle, most of local fabrics in Egypt still produced by traditional methods without take in consideration to achieve the maximum comfort functional properties and required age appropriate to use them. As a result, local automotive fabrics are not suitable enough to meet the employment needs or be compete in foreign markets. Therefore, it was necessary to study the possibility to improve the production of weft knitting pile fabrics to meet the employment needs, climatic changes and achieve the required quality and functional performance properties by controlling the machines adjustment and using different constructions.

The main purpose of this research is to study the effect of some pile weft knitted fabrics constructions factors on their functional performance characteristics. Regarding to theoretical modeling, it is assumed that various fabric structures demonstrate different mechanical and functional properties. This matter is base of sample preparation and plan of experiments. Different fabric structures (8 Terry/velour &11 Fur) with various constructions parameters were made.

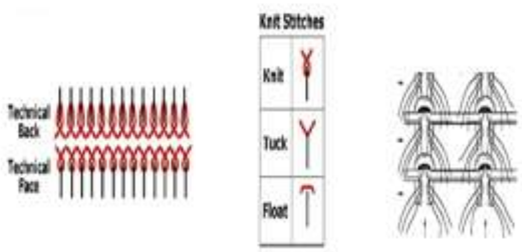

Fig. (1) Terry/velour Structure and Manufacturing

Table (1) shows the specification of Terry/velour machine which used to produce samples under study while Table (2) shows Terry/velour machine adjustments.

Table (1) The Specification of Terry/velour Machine

Machine's specification	**Cut terry/velour Machine**
Company	PAI-LUNG
Machine's type	Double
Machine's Model	PL-XDSPS
Made in	Taiwan
Year of made	2012
Serial . No	A1100561
Construction	Rib
Machine gauge (Needle / Inch)	20

Cylinder diameter (Inch)		30"
Needle number		1860
Number of feeders		48
Tracks	Cylinder	1
	Dial	2

Table (2-3) Terry/velour Machine Adjustments

No.	Yarn tension		Feeding Wheel				Dial Point	Spooler	Cutter Type
	Face	Back	Face		Back				
1	4	0	25	3.5 cm	15	5 cm	40 (6.3)	9 C 1/2	C3
2	4	0	39	7 cm	40	7 cm	40 (3.6)	9 B 1/2	C7
3	4	0	15	6.8 cm	55	6.5 cm	53 (5.3)	9 B 1/2	C3
4	4	0	20	5.5 cm	50	4.5 cm	50 (5.1)	7 B 1/2	C3
5	4	0	5	5.5 cm	32	5 cm	50 (5.1)	3 B 1/2	C3
6	4	0	20	5.5 cm	50	4.5 cm	50 (5.1)	7 B 1/2	C3
7	4	0	20	5.5 cm	5	6 cm	50 (5.1)	16 B 1/2	C3
8	4	0	40	5 cm	43	4.5 cm	50 (5.1)	3 B 1/2	C3

Table (3) shows Terry/velour samples specification.

Table (3) Terry/velour Samples Specification

No.	Materials		Yarn count		Stitch density / cm^2	Stitch Length (mm)	Pile Length (mm)	Thickness (mm)	Weight gm/ m^2
	F	B	F	B					
1	Cotton	Polyester (loose fiber)	30/1	150/1	145	3.43	2	1.134	288
2					145	3.43	1.1	1.206	285
3	flat Polyester		75/36		132	3.80	2	1.2	250
4	Cotton		30/1		132	3.80	2	1.3	300
5	Polyester (Micro fiber)		100/1 44		132	3.80	2	1.1	235
6	Cotton		30/1		189.75	3.33	2	1.422	356
7					154	3.40	2	1.268	307
8					141.75	3.51	2	1.116	260

2.2. Fur (Sliver Knit) Fabrics

As shown in Figure (2), Sliver knit fabric is characterized by a longer pile on the fabric surface. Sliver knit fabrics have longer and denser piles on the fabric surface than other pile jerseys.

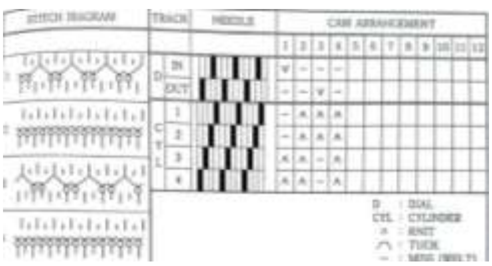

Fig. (2) Fur Structure and Manufacturing

Table (4) shows the specification of Fur machine which used to produce samples under study while Table (5) shows Terry/velour machine adjustments.

Table (4) The Fur Machine Specification

Machine's specification		**Fur Machine**
Company		KEUMYONG
Machine's type		Double
Machine's Model		KXPL-16V
Made in		Korea
Year of made		2006
Serial . No		060514-1
Construction		Rib
Machine gauge (Needle / Inch)		16
Cylinder diameter (Inch)		26
Needle number		1296
Number of feeders		28
Tracks	**Cylinder**	4
	Dial	2

Table (5) Fur Machine Adjustments

No.	Dial Point	Machine Carriage	Needle arrangement		Knifes arrangement	Yarn tension		
			Track 1	Track 2		F	B	L. Yarn
1	43(.4)	85(1.5)	1,2,1	3,4,3	K1+2miss+K2+2miss+K1	15	4	3
2	43(.4)	85(1.5)	1,2,3,4	1,2,3,4	K1+1miss+K2+1miss+K1	0	4	2
3	43(.4)	85(1.5)	1,2,3,4	1,2,3,4	K1+1miss+K2+1miss+K1	0	4	2
4	43(.4)	85(1.5)	1,2,3,4	1,2,3,4	K1+1miss+K2+1miss+K1	0	3	3
5	43(.4)	85(1.5)	1,2,3,4	1,2,3,4	K1+1miss+K2+1miss+K1	0	4	3
6	43(.4)	85(1.5)	1,2,3,4	1,2,3,4	K1+1miss+K2+1miss+K1	0	4	3
7	85(1)	85(1.5)	1,2,3,4	1,2,3,4	K1+1miss+K2+1miss+K1	0	4	3
8	40(2.5)	85(1.5)	1,2,3,4	1,2,3,4	K1+1miss+K2+1miss+K1	0	4	3
9	40(2.5)	85(1.5)	1,2,3,4	1,2,3,4	K1+1miss+K2+1miss+K1	0	4	3
10	40(2.5)	85(1.5)	1,2,3,4	1,2,3,4	K1+1miss+K2+1miss+K1	0	2	3
11	40(2.5)	85(1.5)	1,2,3,4	1,2,3,4	K1+1miss+K2+1miss+K1	0	2	2

Table (6) shows Terry/velour samples specification.

Table (6) Fur Samples Specification

No.	Materials			Yarn count			Stitch density / cm^2	Stitch Length (mm)	Pile Length (cm)	Thickness (mm)	Weight (gm/m^2)
	F	B	Linked Yarn	F	B	L. Yarn					
1	2 yarn flat Polyester	1 yarn Polyester (loose fiber)	1 yarn Polyester (loose fiber) + 2 yarn flat Polyester	100 /36	150 /1	150 /1 + 100 /36	74	4.84	1.40	0.786	240
2							74	4.84	1.40	0.756	200
3							87.87	3.35	1.40	1.154	264
4	1 yarn Polyester Microfiber	1 yarn Spun Polyester	1 yarn Polyester (loose fiber) + 2 yarn Polyester (micro fiber)	100 /144	30/ 1	150 /1 + 100 /144	87.87	3.35	1.40	1.182	312
5	1 yarn Polyester Microfiber	1 yarn Polyester (loose fiber)	1 yarn Polyester (loose fiber) + 2 yarn Polyester (micro fiber)	100 /144	150 /1	150 /1 + 100 /144	87.87	3.35	1.40	0.756	240
6							85.5	3.37	1.40	1.488	320
7							85.5	3.37	1.10	1.154	285
8							85.5	3.37	1.52	1.688	350
9							99	3.25	1.52	1.968	348
10							83.25	3.40	1.52	1.766	240
11							90	3.32	1.52	1.856	300

2.3. Fabric Testing

To investigate the effect of fabric construction on its functional behavior, different tests were done including:.

- Thickness test, this test was carried out according to the ASTM D1777- 96(2011) e1[11].
- Weight test, this test was carried out according to the ASTM D3776 / D3776M - 09a [12].
- Air Permeability test, this test was carried out according to the ASTM D737 - 04(2012) [13].
- Abrasion resistance test, this test was carried out according to the ASTM D3884 - 09(2017) [14].
- Bursting Strength test, this test was carried out according to the ASTM D3786 / D3786M – 13[15].

I. RESULTS AND DISCUSSIONS

Different fabric structures (8 Terry/velour & 11 Fur) with various constructions parameters were made, these parameters are :

*For Cut terry/velour samples;

- Different type of materials .
- Stitch length (L).
- Pile length.

*For Fur samples,

- Different type of materials .
- Stitch length (L).
- Pile length .
- Needle arrangement.

3.1. Tests Results of Cut terry / velour Samples

3.1. 1. The Effect of Pile length of Cut terry / velour Samples on Its Functional Performance Properties

Figure (3) shows the effect of pile length of cut terry/velour samples on fabric Air permeability property.

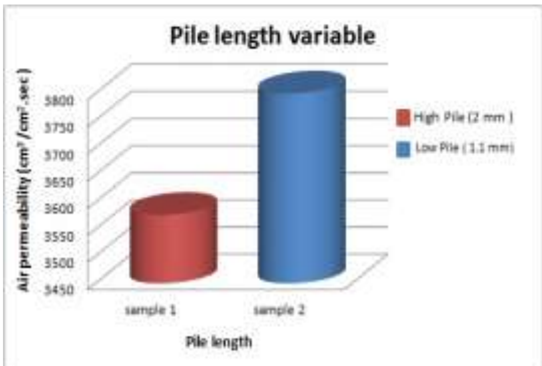

Fig. (3) The Relationship between the Pile Length and the Air Permeability (cm3/cm2.sec) for Cut terry/velour Samples

As shown in Figure (3), It is clear that , Increasing the pile length decreases the air permeability values of produced fabric according to the resistance to air flow, which results in lower air permeability.

Figure (4) shows the effect of pile length of cut terry/velour samples on its Bursting strength property.

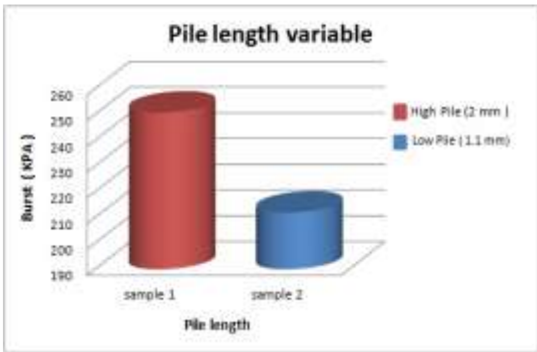

Fig. (4) The Relationship between the Pile Length and the Fabric Bursting strength (KPA) for Cut terry/velour Samples

The bursting strength of knitted fabric is extremely important in many ways. The fabric should have sufficient strength against forces acting upon it during dying, finishing and use. The results for bursting strength revealed that the effect of pile length is highly significant in produced fabrics. Sample with higher pile length and thickness (Sample No.1) have the higher bursting strength property due not only to thickness, but also to stitches density.

Figure (5) shows the effect of pile length of cut terry/velour samples on its Abrasion resistance property .

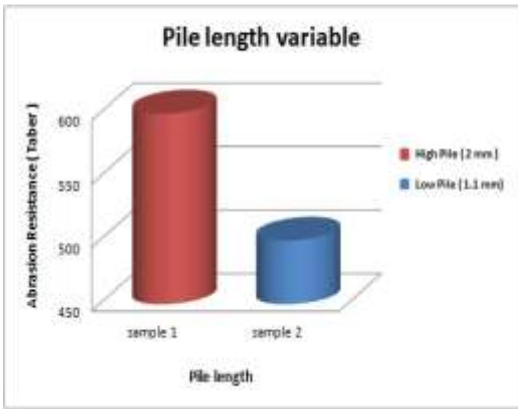

Fig. (5) The Relationship between the Pile Length and the Fabric Abrasion resistance (Taber) for Cut terry/velour Samples

Abrasion resistance is one of the most important properties in automotive textile products.

As shown in Figure (5), It is clear that , Increasing the pile length increases the Abrasion resistance property of produced fabric. Higher values of fabric weight and thickness ensure higher abrasion resistance.

3.1.2. The Effect of Materials Type of Cut terry / velour Samples on Its Functional Performance Properties

Figure (7) shows the effect of material type of cut terry/velour samples on its Air permeability property.

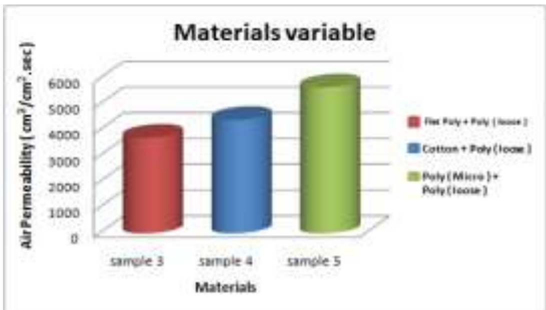

Fig. (7) The Relationship between The Materials Type ofCut terry / velour Samples and its Air Permeability (cm^3/cm^2.sec) Values

As shown in Figure (7), It is clear that, the Air permeability property varied according to the material type. Sample (5) has the highest Air permeability values while sample (3) has the lowest Air permeability values according to its material type. Microfibers fabrics have comparatively higher air permeability properties than normal denier using the same other parameter construction factors. The yarns made from micro denier fiber contain many more filaments than regular yarns producing fabrics with improved breathability.

Figure (8) shows the effect of material type of cut terry/velour samples on its Bursting strength (KPA) property.

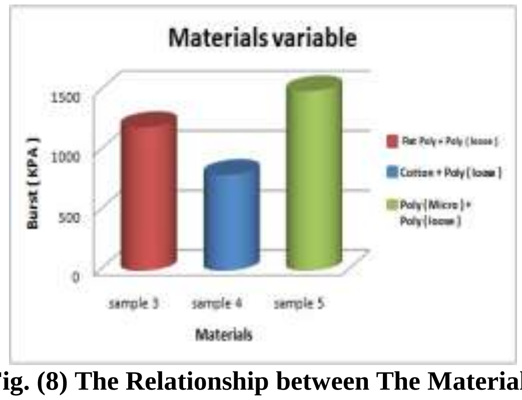

Fig. (8) The Relationship between The Materials Type ofCut terry / velour Samples and its Bursting Strength (KPA) Values

As shown in Figure (8), It is clear that, the Bursting strength (KPA) property varied according to the material type. Sample (5) has the highest Bursting strength values while sample (3) has the lowest Bursting strength values according to its material type. Micro-denier fabrics have comparatively higher bursting strength than normal denier using the same other parameter construction factors. This result due to the fact that more number of fibers can be accommodated in the yarn cross section for the same yarn diameter in case of micro-denier yarns there by increasing the basic tenacity of yarn and also partly due to higher stitch density and tightness factor values in micro denier fabrics.

Figure (9) shows the effect of material type of cut terry/velour samples on its Abrasion resistance (Taber) property.

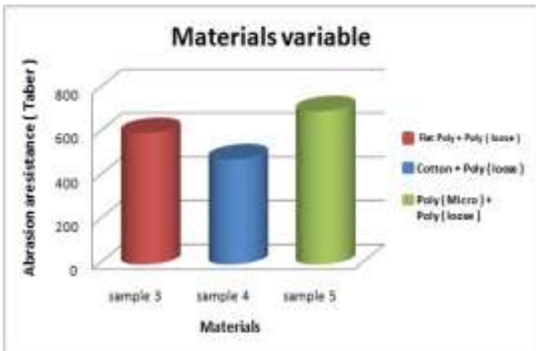

Fig. (9) The Relationship between The Materials Type ofCut terry / velour Samples and its Abrasion resistance (Taber) Values

As shown in Figure (9), It is clear that, the Abrasion resistance (Taber) property varied according to the material type. Sample (5) has the highest Abrasion resistance (Taber) values while sample (3) has the lowest Abrasion resistance (Taber) values according to its material type. Microfibers mechanism causes better "less" abrasion loss properties than multifilament and spun mechanism by using the same other manufacturing parameters. Because microfibers are so fine, many fibers can be packed together very tightly. The denseness results in other desirable properties. With many more fine fibers required to form a yarn, greater fiber surface area results making more abrasion resistance properties possible.

3.1.3. Effect of Stitch length of Cut terry / velour Samples on Its Functional Performance Properties

Figure (10) shows the effect of Stitch length (mm) of cut terry/velour samples on its Air Permeability property.

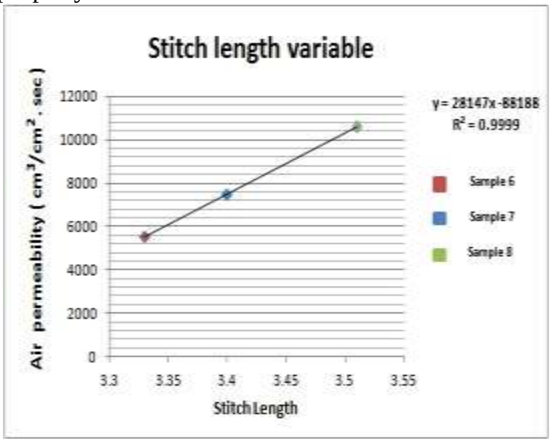

Fig. (10) The Relationship between Stitch length (mm) and Air Permeability (cm^3/cm^2 . sec) Values for Cut terry / velour Samples

It was obvious from Figure (10) that, there is direct relationship between stitch length and its Air Permeability property. The Stitch length has a significant effect on the fabric Air permeability (cm3/cm^2.sec) for all cut terry/velour samples, as the Stitch length increases, the fabric Air permeability was increased, this means that the higher the Stitch length, the higher the fabric Air permeability. The decrease in the Stitch length helps to increase in stitch density which lead to increase to fabric weight and thickness. The open structure gives the ability to the air to pass through fabric without any obstacles due to the lower thickness and stitch density of the fabric.

Figure (11) shows the effect of Stitch length (mm) of cut terry/velour samples on its Bursting Strength property.

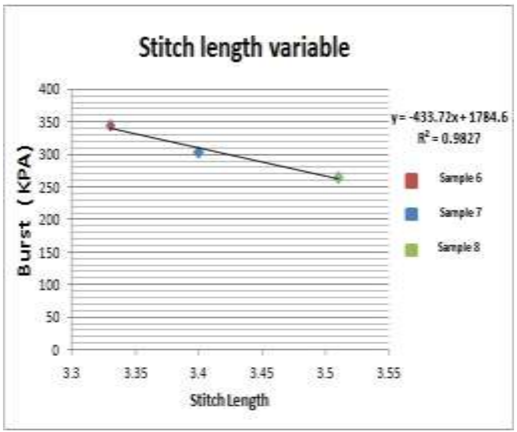

Fig. (11) The Relationship between Stitch length (mm) and Bursting Strength (KPA) Values for Cut terry / velour Samples

It was obvious from Figure (11) that, there is indirect relationship between stitch length and its Bursting Strength property. The Stitch length has a significant effect on the fabric Bursting Strength (KPA) for all cut terry/velour samples, as the Stitch length increases, the fabric Air permeability was decreased, this means that the higher the Stitch length, the lower the fabric Bursting Strength. The significant effect of the stitch length on the bursting strength can be attributed to the less stitch length associated with increasing the fabric weight which leads to higher bursting strength.

Figure (12) shows the effect of Stitch length (mm) of cut terry/velour samples on its Abrasion Resistance property.

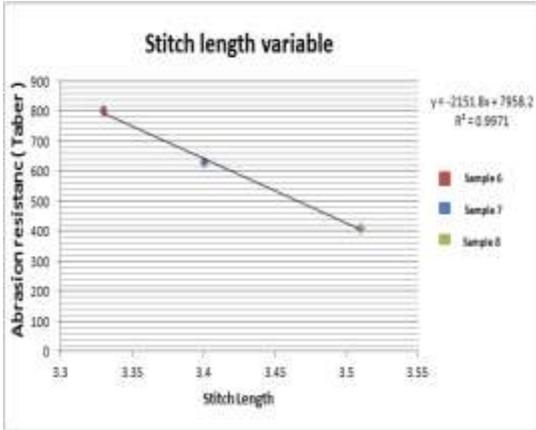

Fig. (12) The Relationship between Stitch length (mm)and Abrasion Resistance (Taber) Values for Cut terry / velour Samples

It was obvious from Figure (12) that, there is indirect relationship between stitch length and its Abrasion Resistance property. The Stitch length has a significant effect on the fabric Abrasion Resistance (Taber) for all cut terry/velour samples, as the Stitch length increases, the fabric Abrasion Resistance was decreased, this means that the higher the Stitch length, the lower the fabric Abrasion Resistance. The significant effect of the stitch length on the Abrasion Resistance can be attributed to the less stitch length associated with increasing the fabric weight which leads to higher Abrasion Resistance (Taber).

3.2. Tests Results of Fur Samples

3.2.1. The Effect of Needles Arrangement of Fur Samples on Its Functional Performance Properties

Figure (13) shows the effect of Needles Arrangement of Fur samples on fabric Air permeability property.

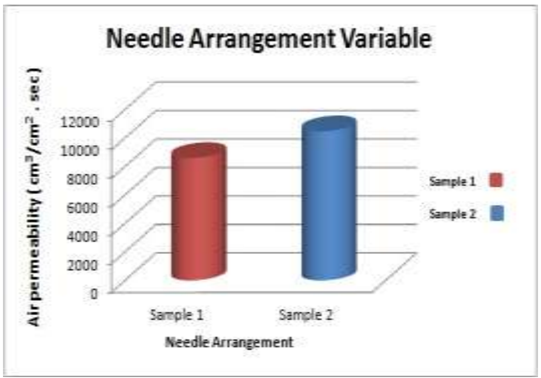

Fig. (13) The Relationship between the Needles Arrangement and Fabric Air permeability (cm^3/cm^2. sec) for Fur Samples

As shown in Figure (13), It is clear that, There is relationship between Needles arrangement and fabric Air permeability property. Air permeability of Sample (1) is lower compared with sample (2) due to different arrangement for needles that caused higher stitch density and tighter fabric which prevent air to pass through.

Figure (14) shows the effect of Needles Arrangement of Fur samples on fabric Bursting strength property.

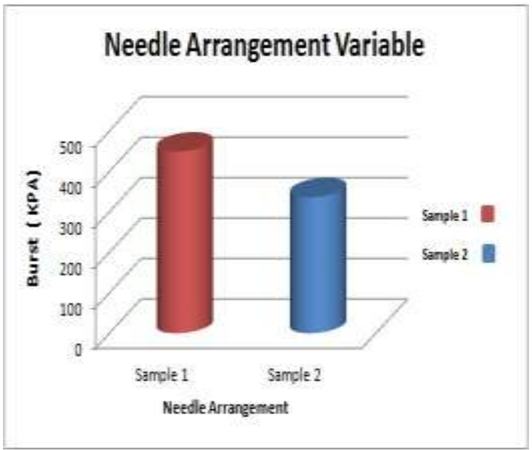

Fig. (14) The Relationship between the Needles Arrangement and Fabric Bursting strength (KPA) for Fur Samples

As shown in Figure (14), It is clear that, There is relationship between Needles arrangement and fabric Bursting strength property. Bursting strength of Sample (1) is higher compared with sample (2) due to different arrangement for needles that caused higher stitch density, tighter fabric and better Bursting strength property .

Figure (15) shows the effect of Needles Arrangement of Fur samples on fabric Abrasion resistance property.

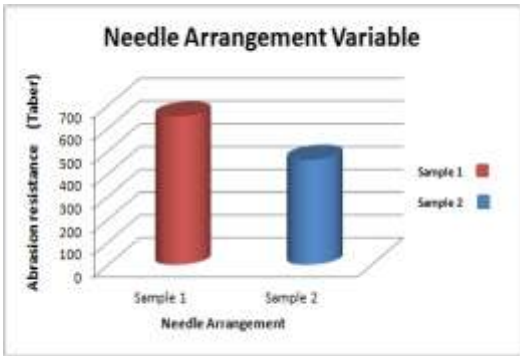

Fig. (15) The Relationship between the Needles Arrangement and Fabric Abrasion Resistance (Taber) for Fur Samples

As shown in Figure (15), It is clear that, There is relationship between Needles arrangement and fabric Abrasion resistance property. Abrasion resistance of Sample (1) is higher compared with sample (2) due to different arrangement for needles that caused higher stitch density, tighter fabric and better Abrasion resistance property .

3.2.2. The Effect of Materials Type of Fur Samples on Its Functional Performance Properties

Figure (16) shows the effect of material type of Fur samples on its Air permeability property.

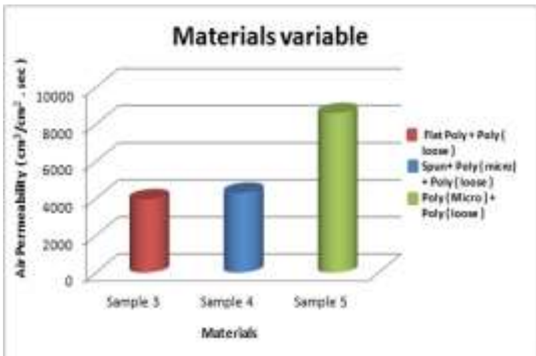

Fig. (16) The Relationship between Materials Type ofFur Samples and its Air permeability (cm^3/cm^2.sec) Values.

As shown in Figure (16), It is clear that, the Air permeability property varied according to the material type. Sample (5) has the highest Air permeability values while sample (3) has the lowest Air permeability values according to its material type. Microfibers fabrics have comparatively higher air permeability properties than normal denier using the same other parameter construction factors. The yarns made from micro denier fiber contain many more filaments than regular yarns producing fabrics with improved breathability. As fabric interstices increase in number and size, air permeability increases. In other words as fabric porosity increases, air permeability increases.

Figure (17) shows the effect of material type of Fur samples on on its Bursting strength (KPA) property.

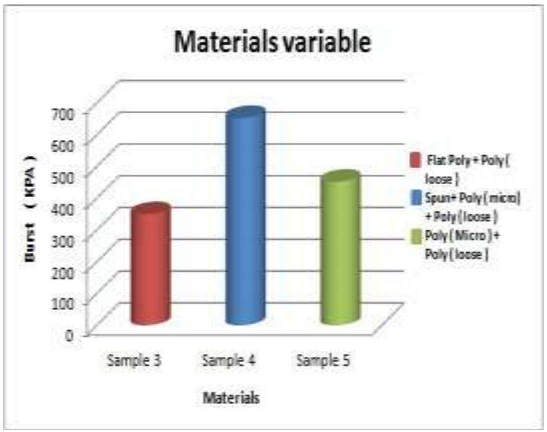

Fig. (17) The Relationship between Materials Type ofFur Samples and its Bursting Strength (KPA) Values

As shown in Figure (17), It is clear that, the Bursting strength (KPA) property varied according to the material type. Sample (4) has the highest Bursting strength values while sample (3) has the lowest Bursting strength values according to its material type. Micro-denier fabrics have comparatively higher bursting strength than normal denier using the same other parameter construction factors. This result due to the fact that more number of fibers can be accommodated in the yarn cross section for the same yarn diameter in case of micro-denier yarns there by increasing the basic tenacity of yarn and also partly due to higher stitch density and tightness factor values in micro denier fabrics.

Figure (18) shows the effect of material type of Fur samples on its Abrasion resistance (Taber) property.

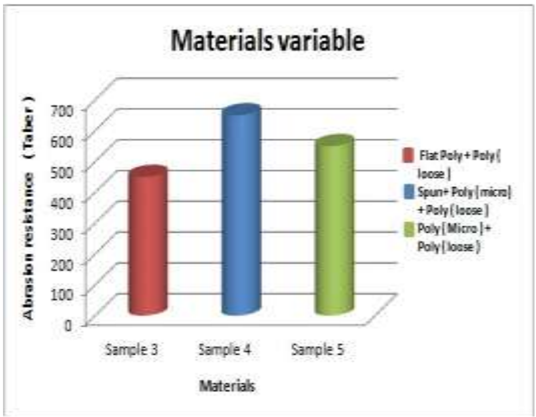

Fig. (18) The Relationship between The Materials Type ofFur Samples and its Abrasion resistance (Taber) Values

As shown in Figure (18), It is clear that, the Abrasion resistance (Taber) property varied according to the material type. Sample (4) has the highest Abrasion resistance (Taber) values while sample (3) has the lowest Abrasion resistance (Taber) values according to its material type. Microfibers mechanism causes better "less" abrasion loss properties than multifilament and spun mechanism by using the same other manufacturing parameters. Because microfibers are so fine, many fibers can be packed together very tightly. The denseness results in other desirable properties. With many more fine fibers required to form a yarn, greater fiber surface area results making more abrasion resistance properties possible.

3.2.3.The Effect of Pile length of Fur Samples on Its Functional Performance Properties

Figure (19) shows the effect of pile length of Fur samples on its Air Permeability property.

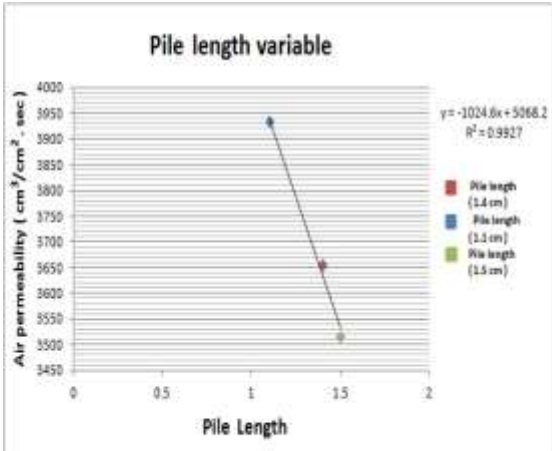

Fig. (19) The Relationship between Pile Length (cm)and Air Permeability (cm^3/cm^2 . sec) Values for Fur Samples

It was obvious from Figure (19) that, there is indirect relationship between pile length and its Air Permeability property. The pile length has a significant effect on the fabric Air permeability ($cm3/cm^2$.sec) for all Fur samples, as the pile length increases, the fabric Air permeability was decreased, this means that the higher the pile length, the lower the fabric Air permeability. The increase in the pile length lead to increase the fabric weight and thickness which prevent the air to pass through.

Figure (20) shows the effect of pile length (cm) of Fur samples on its Bursting Strength property.

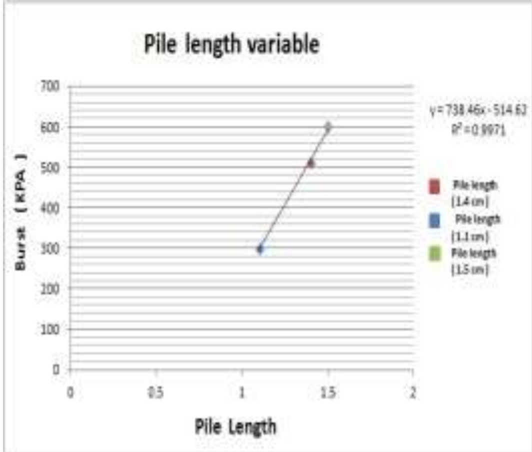

Fig. (20) The Relationship between the Pile Length(cm) and Bursting Strength (KPA) Values for Fur Samples

It was obvious from Figure (20) that, there is direct relationship between pile length and its Bursting Strength property. The pile length has a significant effect on the fabric Bursting Strength (KPA) for all Fur samples, as the pile length increases, the fabric weight was increased, this means that the higher Pile length, the higher the Bursting Strength. The increase in the Pile length helps to increase in fabric thickness and weight which leads to higher bursting strength.

Figure (21) shows the effect of pile length of Fur samples on its Abrasion Resistance property.

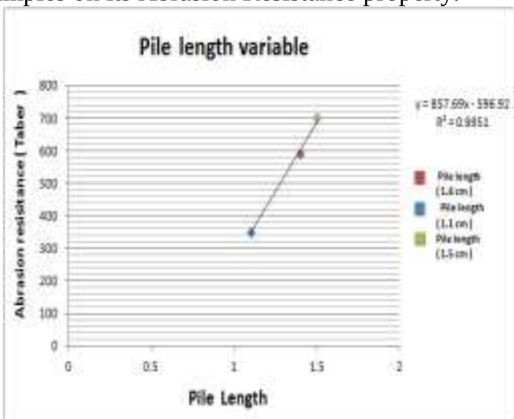

Fig. (21) The Relationship between the Pile Length(cm)and Abrasion Resistance (Taber) Values for Fur Samples

It was obvious from Figure (21) that, there is direct relationship between pile length and its Abrasion Resistance property. The pile length has a significant effect on the fabric Abrasion Resistance (Taber) for all Fur samples, as the pile length increases, the fabric weight was increased, this means that the higher Pile length, the higher the Abrasion Resistance. The increase in the Pile length helps to increase in fabric thickness and weight which leads to higher Abrasion Resistance (Taber).

3.2.4. Effect of Stitch length of Fur Samples on Its Functional Performance Properties

Figure (22) shows the effect of Stitch length (mm) of Fur samples on its Air Permeability property.

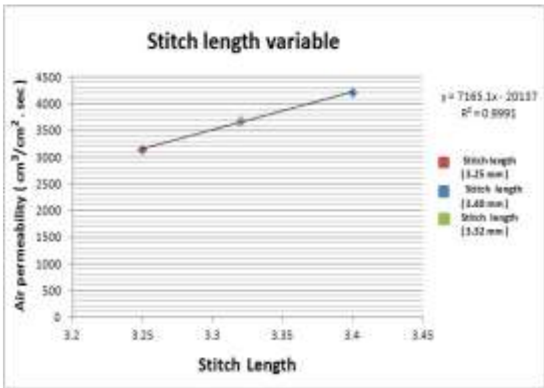

Fig. (22) The Relationship between Stitch length (mm)and Air permeability (cm^3/cm^2.sec) Values for Fur Samples

It was obvious from Figure (22) that, there is direct relationship between stitch length and its Air Permeability property. The Stitch length has a significant effect on the fabric Air permeability ($cm3/cm^2$.sec) for all Fur samples, as the Stitch length increases, the fabric Air permeability was increased, this means that the higher the Stitch length, the higher the fabric Air permeability. The decrease in the Stitch length helps to increase in stitch density which lead to increase to fabric weight and thickness. The open structure gives the ability to the air to pass through fabric without any obstacles due to the lower thickness and stitch density of the fabric.

Figure (23) shows the effect of Stitch length (mm) of Fur samples on its Bursting Strength property.

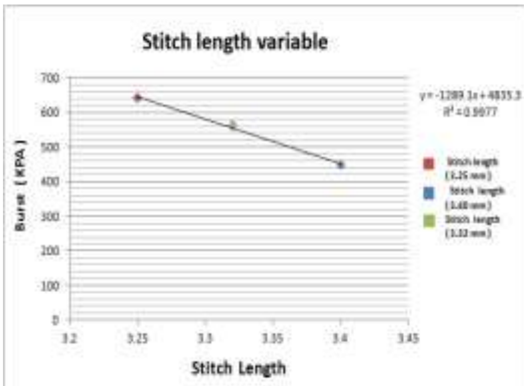

Fig. (23) The Relationship between Stitch length (mm) and Bursting Strength (KPA) Values for Fur Samples

It was obvious from Figure (23) that, there is indirect relationship between stitch length and its Bursting Strength property. The Stitch length has a significant effect on the fabric Bursting Strength (KPA) for all Fur samples, as the Stitch length increases, the fabric Air permeability was decreased, this means that the higher the Stitch length, the lower the fabric Bursting Strength. The significant effect of the stitch length on the bursting strength can be attributed to the less stitch length associated with increasing the fabric weight which leads to higher bursting strength.
Figure (24) shows the effect of Stitch length (mm) of Fur samples on its Abrasion Resistance property.

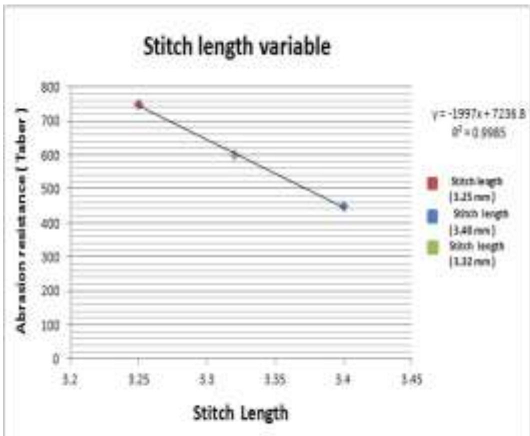

Fig. (24) The Relationship between Stitch length (mm) and Abrasion Resistance (Taber) Values for Fur

It was obvious from Figure (24) that, there is indirect relationship between stitch length and its Abrasion Resistance property. The Stitch length has a significant effect on the fabric Abrasion Resistance (Taber) for all cut terry/velour samples, as the Stitch length increases, the fabric Abrasion Resistance was decreased, this means that the higher the Stitch length, the lower the fabric Abrasion Resistance. The significant effect of the stitch length on the Abrasion Resistance can be attributed to the less stitch length associated with increasing the fabric weight which leads to higher Abrasion Resistance (Taber).

II. CONCLUSION

Automotive textiles represent the most valuable world market for technical textiles and within this segment there is a broad spectrum of products comprising novel textile structures with performance properties and attractive design. In this paper, the performance properties and various factors affecting it are discussed for car interiors fabrics using different weft pile constructions. Different fabric structures (8 Terry/velour & 11 Fur) with various constructions parameters were made. It has been proven that different pile knitting structures (Terry/velour & Fur) have different functional and mechanical properties. Well-designed weft knitted pile fabrics, have been shown to be promising for car interiors textiles. A pile fabric, as an artificial fabric, possesses many alterable factors, e.g., knitting materials, knitting techniques, and fabric characteristics. Type of materials, Stitch length (L), Pile length and Needle arrangement play important roles in the other properties evaluation, such as air permeability, abrasion resistance test and bursting Strength test. Weft knitted pile fabrics with unique structures and functional performance properties are important elements of the car interiors field.

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