APPLICATION OF JUTE TREATED WITH FLAME RETARDANT IN HOOD AND TRUNK LINING

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Abstract

This research is mainly concerned with fabrics used in hood and trunk lining . Woven technique was applied to produce these fabrics, using jute 9 and 12 Libra with two structures (irregular hopsack 2/1 and twill 2/1). The produced fabrics were treated with flame retardant .Some more results were reached concerning structures and materials to reach the expected results for end uses.

I. Introduction

The industrial fabrics industry will continue to develop to meet the needs of society and the growth of the industry is assured because industrial fabrics are leading the way for materials to be structured to solve problems and to be engineered to meat the special performance of products such as trunk and hood lining. In the past few years, car manufacturers have focused on automobile interiors from a merely function as not only do interior trims serve to differentiate models, but materials and designs can also be used to tailor the some model to different target groups. [(1)] Textiles used in the automotive industry may age due to wear and tear, such processes have to be taken into consideration when dealing with direct materials and also play a part in the effort to improve age resistance as required by the automotive industry. [(2)] Over the past decade improvements in both functional and appearance durability of automotive trim have been significant . Technology applied in the form of better polymers, stabilizers and testing procedures has contributed to these improvements [(3)] About forty automotive parts or components including trunk, under headliners, floor mats, padding, package trays, door, panels air filter and other miscellaneous uses , are made of warp knit, flat woven, circular knit and nonwoven [(4)] fabrics provide comfort and better appearance in car interiors while still meeting the performance and consistency requirements [(5)] ,these fabrics must also meet the needs of fashion function and durability required by the automakers .

Trunk linings, Fabrics usage in the trunk linings industry return to year 1985 [(6)] when the trunk has become an extension of the car interior. The main requirements are low cost, light weight and mauldobility , achieved by resignation. [(7)] Generally the trunk linings has to be insulated against incident heat and thus additional heat barrier is thus necessary between the trunk and the interiors [(8)]

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Hood lining , The hood liner is simply a covering for the metal roof inside the car and consisted of a piece of fabric . PVC or some other material , sometimes simply held enplane only at a few points .It has been developed over the last 20 years into a sophisticated module component , important for thermal and sound insulation. (7) The functions of the interiors trim head liner part have evolved during the past several years to being more than just a thermal insulation and interiors cover for the metal roof assembly . Future head liner designs include integrated structures to reduce or eliminate roof bows for a net weight reduction. Also hood liners are used as part of the acoustical package design to make the cars quieter by preventing noise and heat from reaching the passengers comportment (9)

A variety of materials are used for packaging fabrics, sacking bags, floor covering …etc. , these products including natural fibers such as jute and sisal. No attempt has been made to develop hood liners and roof panels , which require stability at very high temperatures . This research describes the physical mechanical and thermal properties of these fabrics (4)

Jute, The use of natural materials is being examined and in fact is being used in some cars .Jute is an example of natural fibers used in this branch ,(7) as jute fiber is available in plenty and a comparatively low cost. (10) So it is being increasingly used to produce diversified products such as carpets , low cost blankets , upholstery …etc. (11) Now jute, as a new trend has emerged in the manufacturing of industrial textiles as civil engineering and transportation .

Jute fibers consists of cellulose 58 – 63% hemicellulose 20-22% Lignin 12-14 % , wax and fats .4-.8% protein 0.8% – 2.5% and mineral 0.6-1.2% .(12) Jute has many important characteristics including agro – renewability , ecofriendliness , bio-degradability , durability , better tensile strength , anti statistic property , low thermal conductivity , moderate moisture regain , good insulation property, good affinity towards various classes of cellulosic dyes and compatibility in blending with other allied . (10) For previous characteristics jute fibers were chosen to be used in this research for producing samples used in hood and trunk linings.

Flame retardant ,The need for reducing the flammability of cellulose has been recognized for several centuries .At the present time several countries have regulations restricting the sale or use of the dangerously flammable textiles. (13)

In the past decades, a number of chemical procedures have been devoloped to reduce the flammability of cellulosic substrates. However ,only a few are still being practiced .Currently , the durable flame retardant finishing systems for cellulosic fibers are evailable to the industry . (14) Flame retardand can be obtained in two ways by using inherently flame retardant fibers such as Nmex aramid by treating (coating the fiber or fabric with flame retardant chemicals , where the second method may be less expensive than using inherently flame retardant fibers. (15)

2.The experimental work

There are no previous studies about using jute for hood and trunk lining. So this study aimed to produce fabrics used in trunk and hood linings ,using jute 9 and 12 Libra. Two different woven structures were used in this research to produce all samples (irregular hopsack 2/1and twill weave 2/1)

Finishing technology

Coating and laminating offer methods for improving and modifying the physical properties and appearance of fabrics and also the development of entirely new products by combining the benefits of fabrics . Flame retardant of textiles is very important for the improvement of safety characteristics of industrial textiles .In addition flame retardant in coating is necessary to improve the fire behaviour of materials (16) as jute burns in the presence of oxygen and high temperature . Reducing the flammability of jute is important for fabrics used in this industry, (14) so all sample produced in this research were treated with flame retardant by fire coat 215 (mixture of Poly Silicate, Bicarbonate Sodium and Diethylene Glycol)

Table (1) The specification of the machine used for producing samples

No	Property	Specification
1	Model	One Mack
2	Company	Machine of jute
3	Year of manufacturing	1956
4	The manufacturer country	James Mackie & Son LMT
5	Shedding system	Dobby
6	Number of healds	8 healds
7	Width of the machine	90 cm

Table (2) the specifications of the samples, produced in this research

No	Property	Specification
1	Warp type	Jute
2	Weft type	Jute
3	Count of warp yarns	6 Libra
4	Count of weft yarns	9 & 12 Libra
5	Warp set (ends per cm)	32 /10 cm
6	Weft set (picks per cm)	18,24,,30 &35 /10 cm
7	Fabric structures	irregular hopsack 2/1and Twill weave 2/1
8	Reed used (dents per cm)	3 dents per/cm
9	Denting	1 end per dent
11	Finishing	Samples were treated with flame retardant

Table (3) the specifications of the all samples produced in this research

Fabric construction						
Samples No.	Yarn type	Fabric structure	Yarn count (Libra)		Warp set (ends)	Weft set (picks)
			Warp	Weft		
Sample No .1	Jute	Twill weave 2/1	6	12	32 /10 cm	35 /10 cm
Sample No. 2	Jute	Twill weave 2/1	6	12	32 /10 cm	28 /10 cm
Sample No. 3	Jute	Twill weave 2/1	6	12	32 /10 cm	24 /10 cm
Sample No .4	Jute	Twill weave 2/1	6	12	32 /10 cm	18/10 cm
Sample No .5	Jute	Irregular hopsack 2/1	6	12	32 /10 cm	35 /10 cm
Sample No .6	Jute	Irregular hopsack 2/1	6	12	32 /10 cm	28 /10 cm
Sample No .7	Jute	Irregular hopsack 2/1	6	12	32 /10 cm	24 /10 cm
Sample No .8	Jute	Irregular hopsack 2/1	6	12	32 /10 cm	18/10 cm
Sample No. 9	Jute	Twill weave 2/1	6	9	32 /10 cm	35 /10 cm
Sample No. 10	Jute	Twill weave 2/1	6	9	32 /10 cm	28 /10 cm
Sample No. 11	Jute	Twill weave 2/1	6	9	32 /10 cm	24 /10 cm
Sample No .12	Jute	Twill weave 2/1	6	9	32 /10 cm	18/10 cm
Sample No .13	Jute	Irregular hopsack 2/1	6	9	32 /10 cm	35 /10 cm
Sample No .14	Jute	Irregular hopsack 2/1	6	9	32 /10 cm	28 /10 cm

Sample No .15	Jute	Irregular hopsack 2/1	6	9	32 /10 cm	24 /10 cm
Sample No .16	Jute	Irregular hopsack 2/1	6	9	32 /10 cm	18/10 cm

Tests

Several tests were carried out to evaluate the produced fabrics, these tests are **Thermal isolation of fabrics,** this test was carried out according to the (ASTM-D 1682) where the samples were exposed to 130 ^{0} C [17]

Flame retardant of fabrics, this test was carried out according to the BS 3119-3120) [18]

Fabric abrasion resistance, this test was carried out according to the (ASTM-D1175) [19]

Fabric thickness, this test was carried out according to the ISO 2094 & BS 4052 [20]

Fabric weight, this test was carried out according to the ASTM-D 3776- 79 [21]

3.Results and Discussion

Results of experimental tests carried out on the produced samples were statistically analyzed and presented in the following tables and graphs.

Thermal isolation

Table (4) the results of the thermal isolation test applied to the produced samples

Thermal isolation (^{0}C)								
	15 min		45 min		75 min		105 min	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
1	54	22.5	59	27.5	60.5	31	61	33
2	55.5	23	62.5	30	63	35	66.5	37
3	59	26.5	64	32	64.5	36	67	38
4	63	28	66.5	34.5	65	37	68.5	39
5	54.5	24	61	29	62	33	63.5	34.5
6	57	27.5	63.5	31	64	35.5	64.5	37.5
7	61	٢٦	66	34	67	36	69	38.5
8	64	29	67	35	68	37.5	69.5	39
9	56	25	61	30	65.5	33.5	64	35.5
10	58	28.5	63.5	31	67.5	35	67	38
11	57	26	65	34	68	37	69.5	38.5
12	63	30	67.5	35	66.5	36	68	39
13	56	25	60.5	30	63.5	34	65.5	37
14	57.5	27	63	32	64.5	35.5	67.5	38
15	58.5	29	64	34.5	66.5	37	68	39
16	60.5	30	66	35	68.5	37.5	69.5	39

It is clear from the diagrams (1) to (6) that irregular hopsack 2/1 has obtained the highest rates of thermal isolation, whereas twill 1/2 has obtained the lowest rates but the difference is insignificant.

It is also obvious from the statistical analysis of the thermal isolation results that there is an inverse relationship between number of ends and picks per cm and thermal isolation. I can report that the increasing in ends and picks cause an obstruction in air passage, causing increasing in thermal isolation.

It can also be noticed from the diagrams that samples made of 12 Libra have recorded the lowest rates of thermal isolation, whereas samples made of 9 Libra have recorded the highest rates. I can report that yarns of 12 Libra have thicker diameter than those of 9 Libra, which cause a decrease in thermal isolation.

I can also notice from the diagrams that there is an inverse relationship between thickness, weight, and thermal isolation. I can state that increasing in thickness and weight means increasing in yarn diameter, number of picks and ends per unit area, which cause an obstruction in air spaces, causing increasing in thermal isolation

It is also clear from tables (5) to (7) of critical F- test and tabulate F- test that there is a highly significant effect of number of picks /cm and fabric structure, number of picks /cm and yarn count, fabric structure and yarn count on thermal isolation and interaction between them

Table (5) tabulate F-test and critical F-test for the effect of number of picks / cm and fabric structure on fabric thermal isolation.

The variables	P-value	Tabulate F-test	Critical F-test
Fabric structure	0.0000	118.1821	3.238867
Number of picks / cm	0.0000	10.99598	4.493998
Interaction	0.0000	26.45515	3.238867

Table (6) tabulate F-test and critical F-test for the effect of number of picks / cm and yarn count on fabric thermal isolation.

The variables	P-value	Tabulate F-test	Critical F-test
Number of picks / cm	0.0000	118.1821	3.238867
Yarn count	0.0000	131.8588	4.493998
Interaction	0.0000	34.40855	3.238867

Table (7) tabulate F-test and critical F-test for the effect of fabric structure and yarn count on fabric thermal isolation.

The variables	P-value	Tabulate F-test	Critical F-test
Fabric structure	0.0000	50.88848	5.317645
Yarn count	0.00701	12.94052	5.317645
Interaction	0.004939	14.75465	5.317640

15 min	**Y=0.29009 X+19.07242**	**R = 0.805028**
45 min	**Y=0.35331X+22.88175**	**R =0.918745**
75 min	**Y=0.24284X+29.03171**	**R = 0.860954**
105 min	**Y=0.23056X+31.47893**	**R = 0.824893**

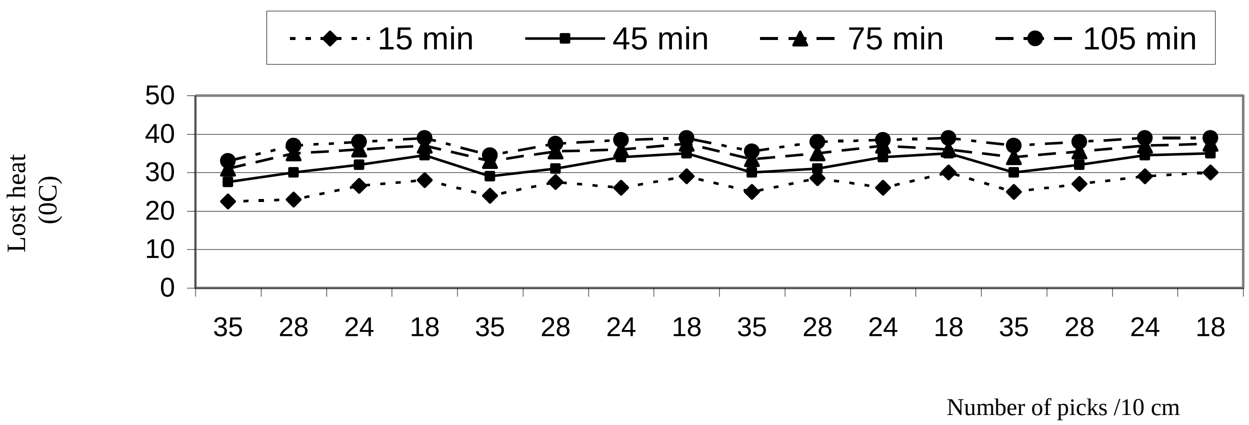

Fig (1)
Effect of number of picks /cm and exposure time on thermal isolation (after treatment)

Z=-0.308919804 X1+9.708333Y-60.35914484 R=-0.997536725

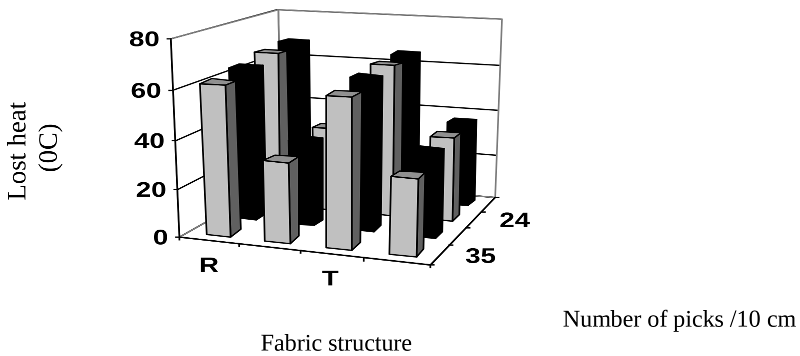

Fig (2)
Effect of number of picks /cm and fabric structure on thermal isolation, at exposure time 75 minute, yarn count 12 Libra (after before treatment)

15 min	**Y=0.791972 X+45.89198**	**R = 0.928175**
45 min	**Y=0.374795X+53.91162**	**R = 0.953013**
75 min	**Y=0.250205X+58.71338**	**R = 0.867251**
105 min	**Y=0.320139X+58.34452**	**R = 0.826098**

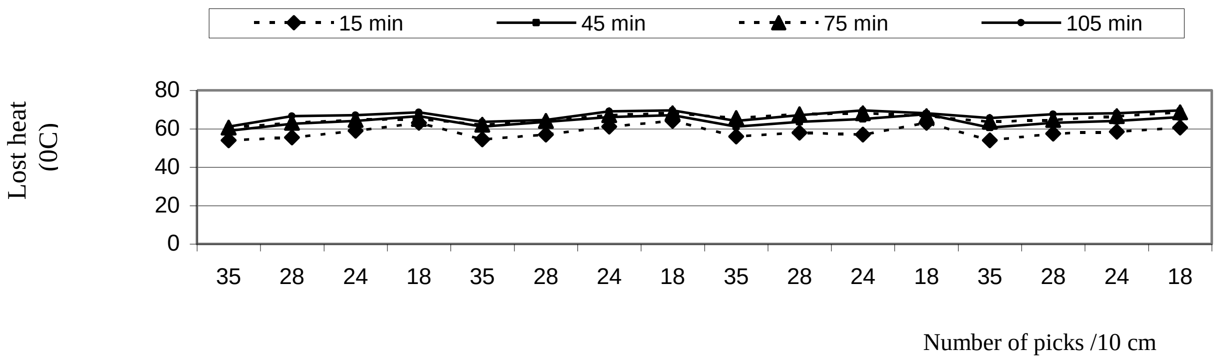

Fig (3)
Effect of number of picks /cm and exposure time on thermal isolation, (before treatment)

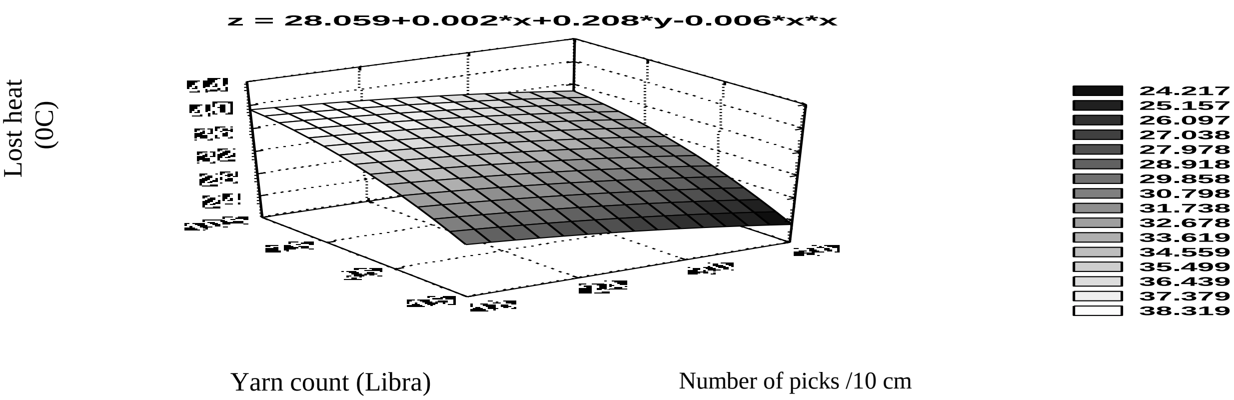

Fig (4)
Effect of number of picks /cm and exposure time on thermal isolation, after treatment

Before treatment	**Y=-0.1875X+37.37**	**R= -0.861359**
After treatment	**Y=-0.6875X+72.5**	**R=-0.858378**

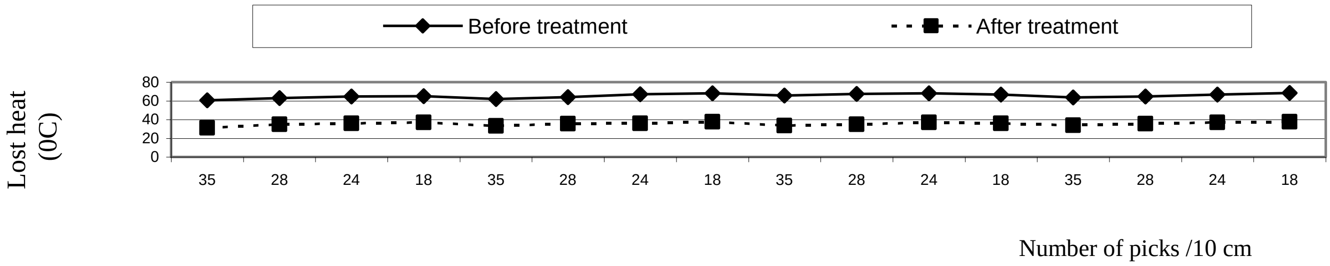

Fig (5)
The relationship between number of picks /cm and thermal isolation, at exposure time 75 minute , at yarn count 9 ,12 Libra ,fabric structure twill 2/1 and irregular 2/1

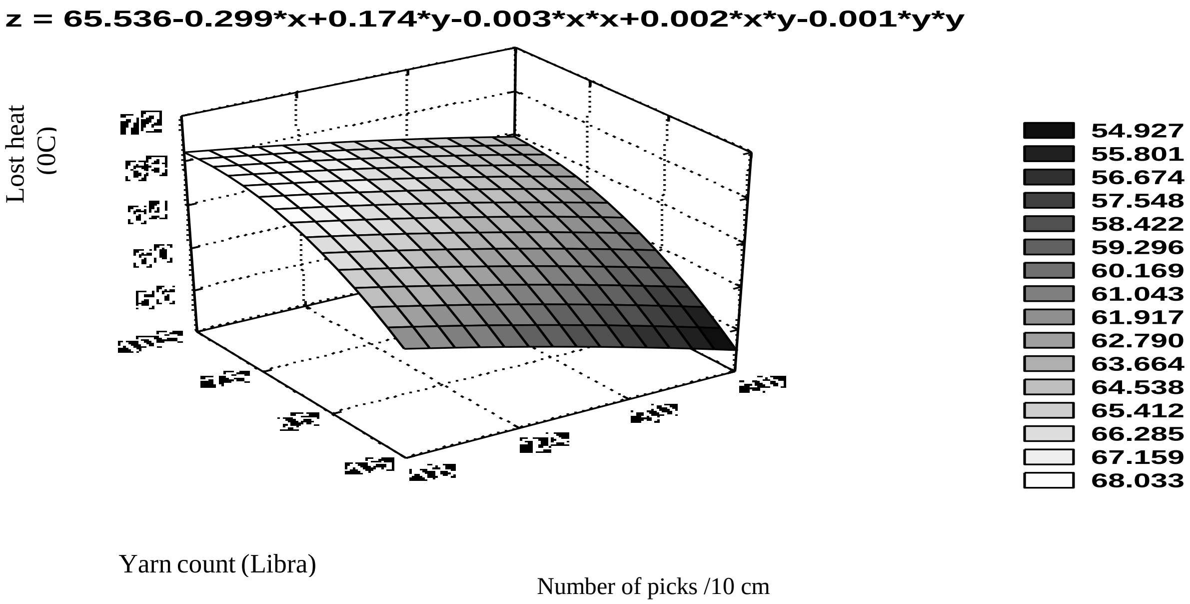

Fig (6)
Effect of number of picks /cm and exposure time on thermal isolation, before treatment

Flame retardant

Table (8) the results of the flame retardant test applied to the produced sample

The test	Flame retardant (%)			
Yarn count	**9 Libra**		**12 Libra**	
Fabric structure / **Number of picks**	**Twill 2/1**	**Irregular hopsack 2/1**	**Twill 2/1**	**Irregular hopsack 2/1**
18	99.142012	99.171598	99.260355	99.230769
24	99.201183	99.111231	99.349112	99.260355
28	99.260355	99.201183	99.332112	99.319527
35	99.378698	99.230769	99.43787	99.319527

It is clear from the diagrams (7) to (10) that all treated samples have successfully

Twill 2/1 **Y=0.009683X+99.09067** **R= 0.996952**
Irregular hopsack 2/1 **Y=-0.005665X+99.13383** **R=0.910927**

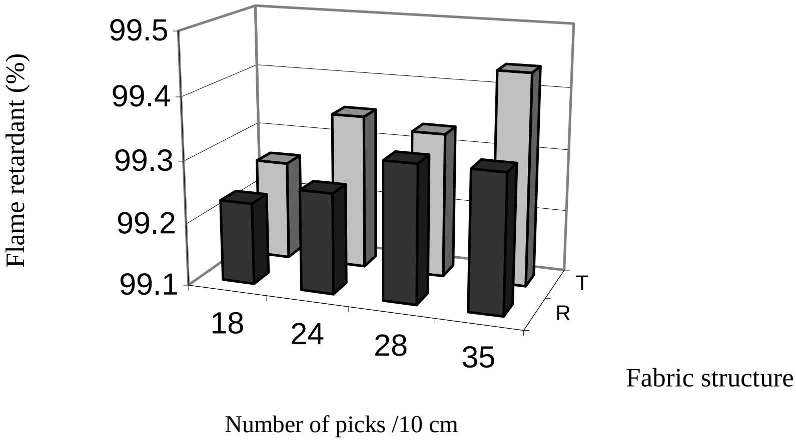

Fig (7)
Effect of number of picks /cm and fabric structure on flame retardant, at 9 Libra

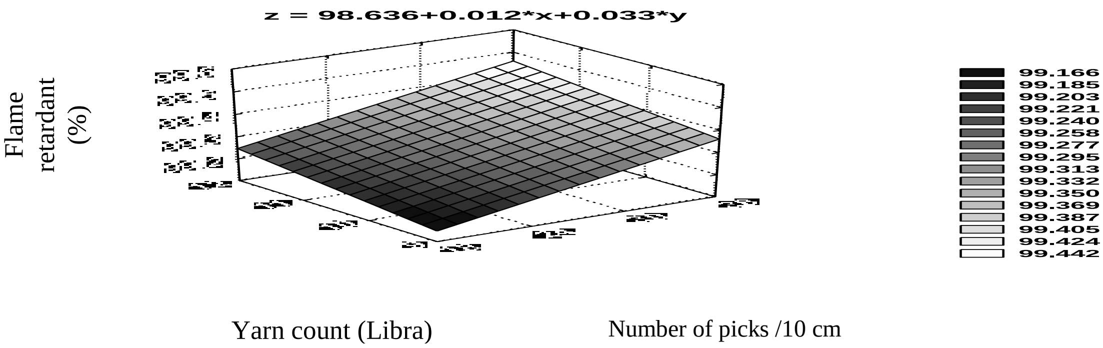

Fig (8)
Effect of number of picks /cm and yarn count on flame retardant, at twill structure

Twill 2/1 **Y=0.000136X+0.48887** **R = 0.993136**
Irregular hopsack **Y=0.000006X+0.99055** **R = 0. 84934**

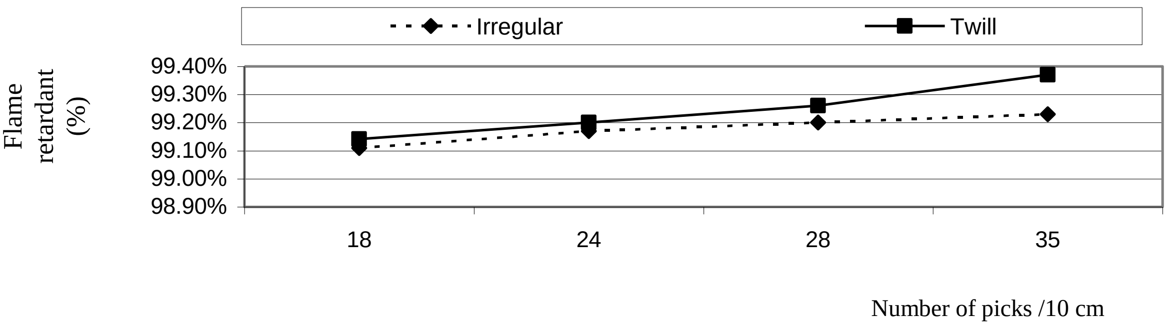

Fig (9)
Effect of number of picks /cm and fabric structure, on flame retardant, at 9 Libra

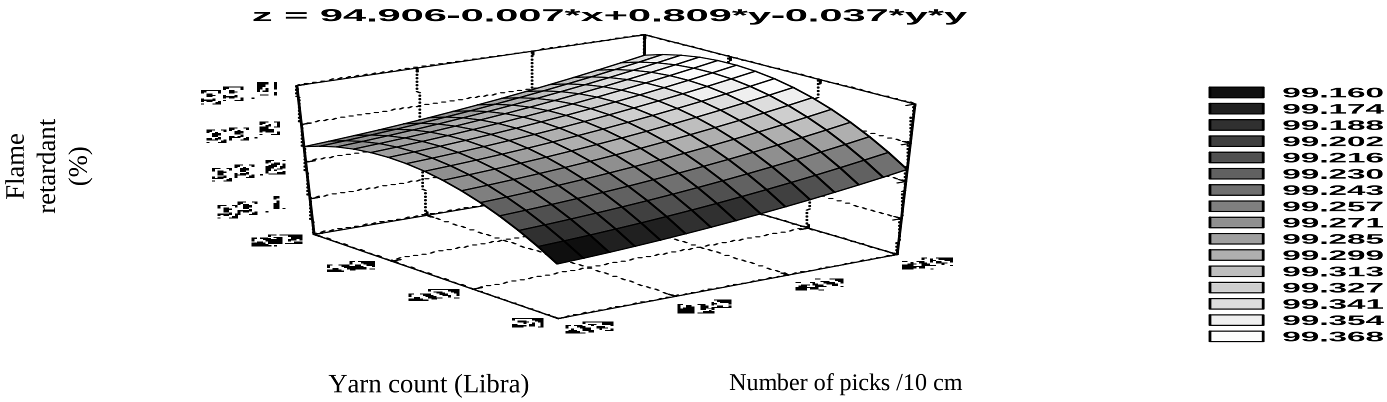

Fig (10)
Effect of number of picks /cm and yarn count on flame retardant , at irregular structure

Abrasion resistance

Table (9) results of the abrasion resistance test applied to the produced samples

The test	**Abrasion resistance (Lost weight ratio %)**							
Yarn count	**12 Libra**				**9 Libra**			
Fabric structure / **Number of picks**	**Twill 2/1**		**Irregular hopsack 2/1**		**Twill 2/1**		**Irregular hopsack 2/1**	
	Before treatment	**After treatment**	**Before treatment**	**After treatment**	**Before treatment**	**After treatment**	**Before treatment**	**After treatment**
١٨	13.87	11.73	11.16	10.93	15.81	16.6	15.12	15.41
٢٤	11.11	10.75	10.31	8.51	15.36	15.56	14.12	14.41
٢٨	10.18	10.09	8.37	6.63	13.74	11.9	13.16	8.43
٣٥	8.125	9.26	7.9	5.36	13.58	10.47	12.28	6.02

Table (10) results of the abrasion resistance test applied to the produced samples

The test	**Abrasion resistance (Lost thickness ratio %)**							
Yarn count	**12 Libra**				**9**			
Fabric structure / **Number of picks**	**Twill 2/1**		**Irregular hopsack 2/1**		**Twill 2/1**		**Irregular hopsack 2/1**	
	Before treatment	**After treatment**	**Before treatment**	**After treatment**	**Before treatment**	**After treatment**	**Before treatment**	**After treatment**
١٨	9.61	7.17	9.09	6.98	10.87	9.64	10.5	8.9
٢٤	6.72	5.63	6.56	5.07	8.03	6.83	7.04	6.78
٢٨	4.12	4.05	3.98	3.71	5.92	4.91	4.49	4.63
٣٥	3.16	2.92	3.14	2.25	3.7	3.23	3.25	3.05

It is obvious from the tables from (9) to (10) that regular hopsack 2/1 has recorded the highest rates of abrasion resistance (lost weight and thickness ratio), whereas twill 2/1 has recorded the lowest rates, but difference is insignificant.

It is also clear from the diagrams from (11) to (14), that there is a direct relationship between number of picks per cm and abrasion resistance (lost weight and thickness ratio). This is for sake of that because of the increased number of picks, which cause fabrics to be more compacted leading to a increase in fabric abrasion resistance (lost weight and thickness ratio).

I can also notice that samples made of 9 Libra have obtained the lowest rates of abrasion resistance (lost weight and thickness ratio), whereas samples made of 12 Libra have obtained the highest rates. This is probably due to that the more diameter the yarns get the more compacted the fabric become and this is for sake of the increasing of the cover factor

It is also clear from tables (11) to (13) of critical F- test and tabulate F- test that there is a highly significant effect of number of picks /cm and fabric structure, number of picks /cm and yarn count, fabric structure and yarn count on fabric abrasion resistance and interaction between them

Table (11) tabulate F-test and critical F-test for the effect of fabric structure and number of picks /cm on fabric abrasion resistance

The variables	**P-value**	**Tabulate F-test**	**Critical F-test**
Fabric structure	0.0000	113.782	3.238867
Number of picks / cm	0.0000	4180.101	4.493998
Interaction	0.0000	354.0714	3.238867

Table (12) tabulate F-test and critical F-test for the effect number of picks /cm and yarn count on fabric abrasion resistance

The variables	**P-value**	**Tabulate F-test**	**Critical F-test**
Number of picks / cm	0.0000	5740.245	3.238867
Yarn count	0.0000	234352	4.493998
Interaction	0.0000	22046.1	3.238867

Table (13) tabulate F-test and critical F-test for the effect fabric structure and yarn count on fabric abrasion resistance

The variables	**P-value**	**Tabulate F-test**	**Critical F-test**
Fabric structure	0.0000	34147.91	5.317645
Yarn count	0.0000	11451.14	5.317645
Interaction	0.0000	999.0314	5.317645

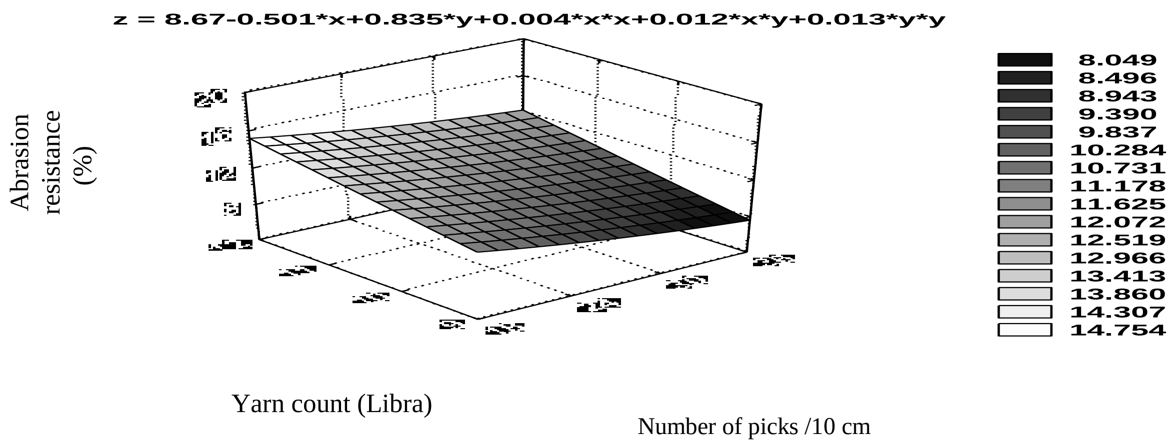

Fig (11)
Effect of number of picks /cm and yarn count on abrasion resistance, at twill 2/1 ,before treatment (lost weight ratio)

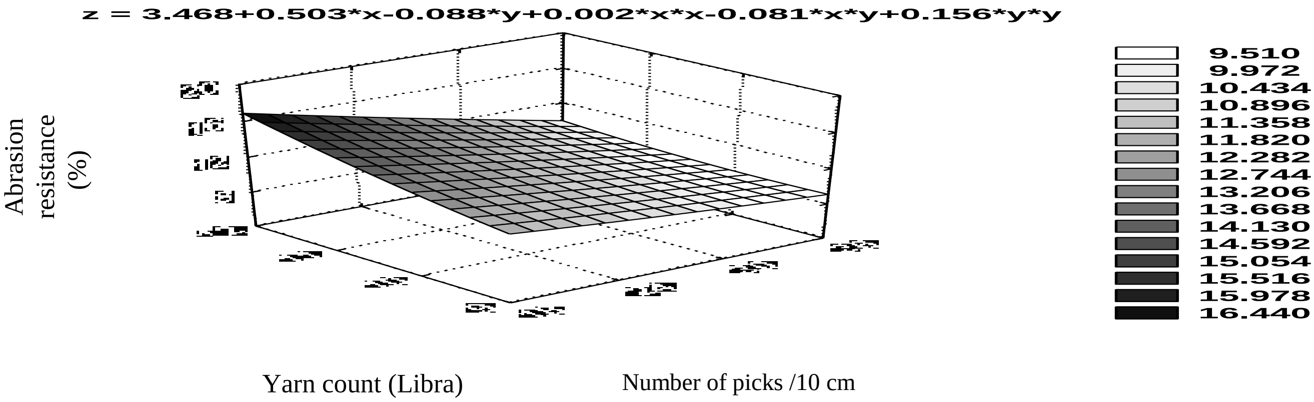

Fig (12)
Effect of number of picks /cm and yarn count on abrasion resistance, at irregular hopsack 2/1, after treatment (lost weight ratio)

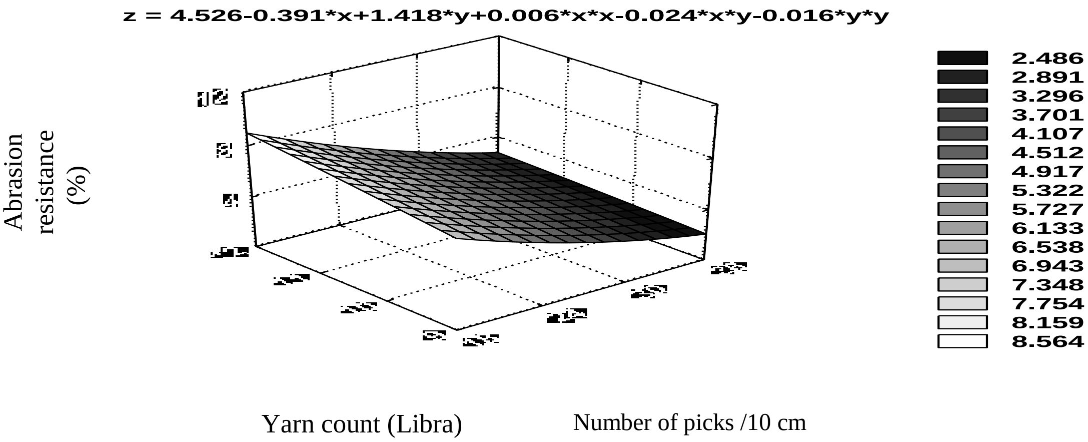

Fig (13)
Effect of number of picks /cm and yarn count on abrasion resistance, at twill 2/1 ,before treatment (lost thickness ratio)

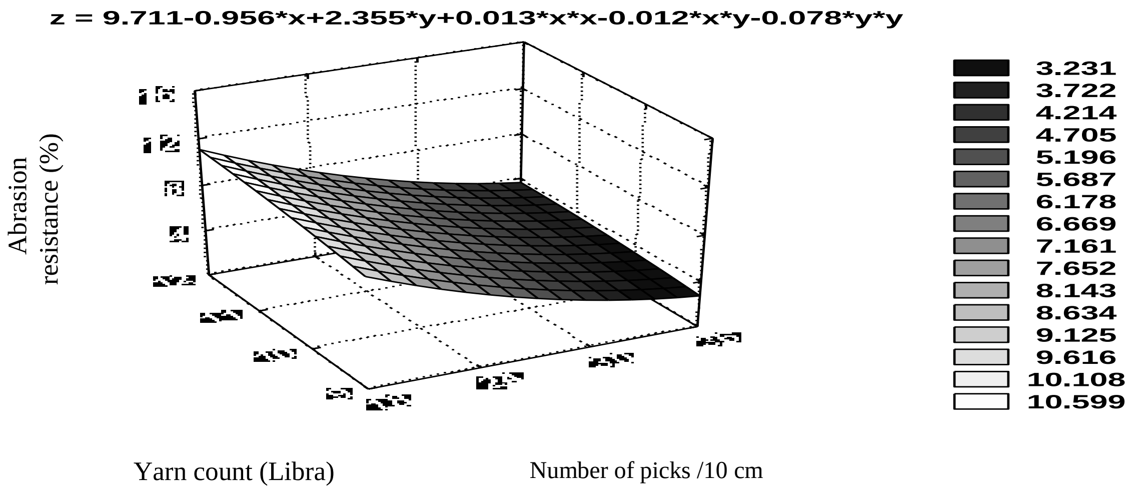

Fig (14)
Effect of number of picks /cm and yarn count on abrasion resistance, at irregular hopsack 2/1, after treatment (lost thickness ratio)

Thickness

Table (14) results of the thickness test applied to the produced samples

Test / Sample No.	Density (c/m3)		Thickness (mm)	
	Before treatment	**After treatment**	**Before treatment**	**After treatment**
1	0.55121	0.4629	0.79	4.59
2	0.50773	0.4583	0.75	4.56
3	0.46656	0.4534	0.75	4.51
4	0.48190	0.4463	0.63	4.50
5	0.53265	0.4636	0.81	4.57
6	0.47362	0.4607	0.80	4.51
7	0.43312	0.4517	0.80	4.52
8	0.38666	0.4411	0.78	4.53
9	0.48029	0.4498	0.68	4.51
10	0.42626	0.4469	0.67	4.49
11	0.39170	0.4411	0.67	4.50
12	0.345	0.4320	0.66	4.47
13	0.48718	0.4512	0.66	4.48
14	0.44343	0.4435	0.64	4.47
15	0.40755	0.4521	0.63	4.46
16	0.35711	0.4427	0.63	4.47

It is clear from the diagrams (15) to (16) , that irregular hopsack 2/1 has recorded the highest rates of thickness, followed by twill weave , which achieved the lowest rates , and it was found that the difference between both of them was insignificant.

This is mainly for sake of that irregular hopsack 2/1 weave have ridges on fabric surface giving irregular hopsack 2/1 weave the ability of being thicker than the other structure.

Another reason for these difference in thickness is yarn count, as samples with 9 Libra have recorded the highest thickness followed by samples with 12 Libra , This is due to that yarns of 9 Libra are thicker than yarns of 12 Libra , causing the produced samples to be thicker.

It was also found that the more yarns per unit area the more thicker the samples become, so samples with 35 picks per cm have recorded the highest rates of thickness, whereas samples with 18 picks per cm have recorded the lowest rates but the difference is insignificant .

It is also clear from tables (15) to (17) of critical F- test and tabulate F- test that there is a highly significant effect of number of picks /cm and fabric structure, yarn count and fabric structure on thickness and interaction between them, also there is a significant effect of fabric structure on thickness, beside of a significant effect of yarn count on thickness, but interaction between them is a highly significant

Table (15) tabulate F-test and critical F-test for the effect of fabric structure and number of picks /cm on fabric thickness

The variables	**P-value**	**Tabulate F-test**	**Critical F-test**
Fabric structure	0.0000	239.3404	3.238867
Number of picks / cm	0.0000	681.5379	4.493998
Interaction	0.0000	116.3664	3.238867

Table (16) tabulate F-test and critical F-test for the effect number of picks /cm and yarn count on fabric thickness

The variables	P-value	Tabulate F-test	Critical F-test
Number of picks / cm	0.0000	196.2641	3.238867
Yarn count	0.0000	490.0753	4.493998
Interaction	0.0000	131.776	3.238867

Table (17) tabulate F-test and critical F-test for the effect fabric structure and yarn count on fabric thickness

The variables	P-value	Tabulate F-test	Critical F-test
Fabric structure	0.0000	196.2641	5.317645
Yarn count	0.0664654	490.0753	5.317645
Interaction	0.000779	131.776	5.317645

Twill 2/1 Y=0.008772504 X+0.499727 R = 0.9035099
Irregular hopsack 2/1 Y=0.00111293 X+0.640785 R = 0.9726202

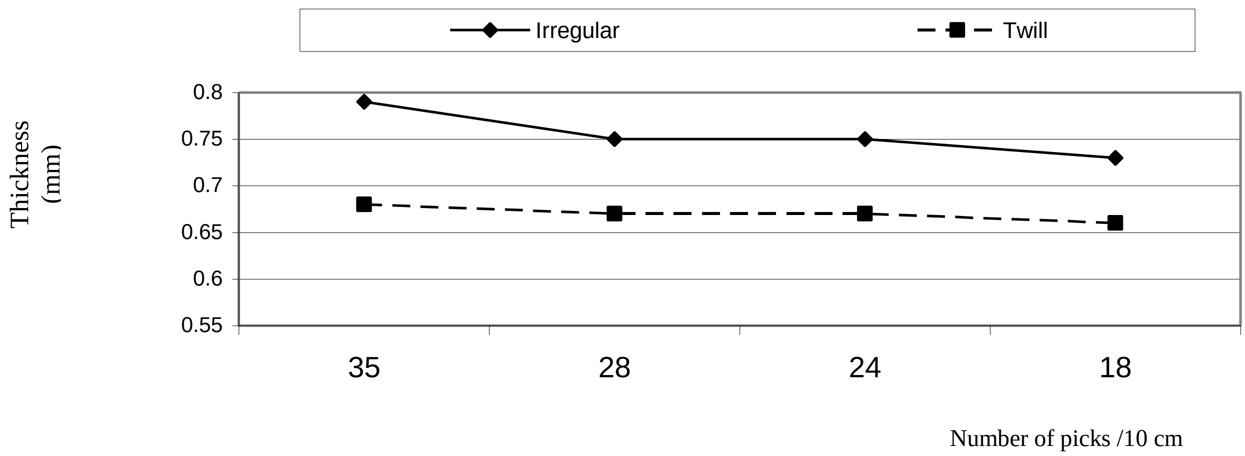

Fig (15)
Effect of number of picks /cm and fabric structure on thickness, at yarn count 12 Libra (before treatment)

Twill 2/1 Y=0.002079 X+4.437938 R = 0.868459
Irregular hopsack 2/1 Y=4.451097X+0.00072 R = 0.829343

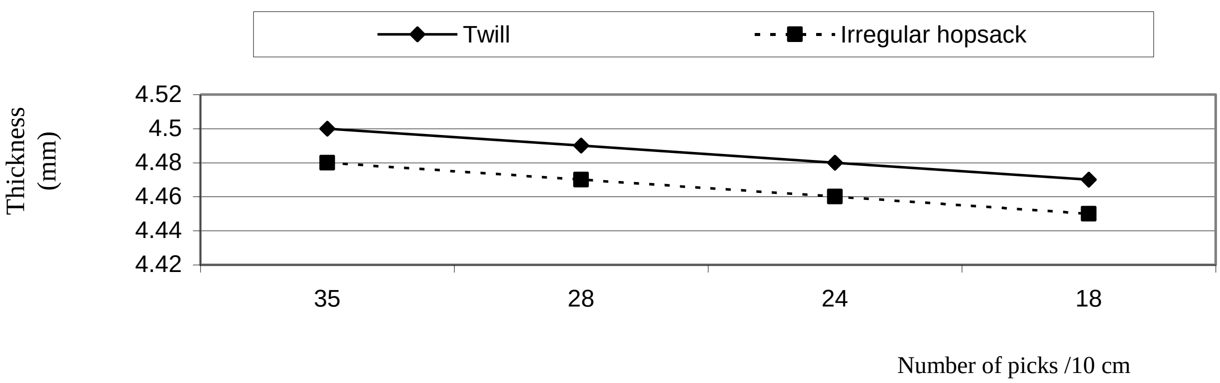

Fig (16)
Effect of number of picks /cm and fabric structure, on thickness, at 9 Libra (after treatment)

Weight

Table (18) results of the thickness test applied to the produced samples

The test	Weight (g/m^2)							
Yarn count	9 Libra				12 Libra			
Fabric structure / Number of picks	Twill 2/1		Irregular hopsack 2/1		Twill 2/1		Irregular hopsack 2/1	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
١٨	326.13	2037.8	321.54	2021.5	435.46	2125	431.45	2118.9
٢٤	285.6	2006.6	283.8	1982.6	380.8	2090.1	378.9	2078.1
٢٨	262.44	1984.9	256.78	2016.7	349.92	2045.8	346.5	2041.7
٣٥	227.7	1931.4	224.98	1978.9	303.6	2008.5	301.6	1998.5

It is clear from the diagram (17) that there was insignificant difference in weight between the two structures.

It is also clear that samples produced of 9 Libra have recorded the highest weight followed by samples with 12 Libra. This is for sake of that yarns of 9 Libra thicker than yarns of 12 Libra, causing the produced samples to be increased in weight.

It was also found that the more yarns per unit area the more thicker the samples become, so samples with 35 picks per cm have recorded the highest weight , whereas samples with 18 picks per cm have recorded the lowest weight.

It is also clear from tables (19) to (21) of critical F- test and tabulate F- test that there is a highly significant effect of number of picks /cm and fabric structure on weight , but interaction between them is significant .Beside of there is a highly significant effect of number of picks /cm and yarn count, fabric structure and yarn count /cm and interaction between them.

It is also clear from figures (18) and (19) that sample produced with warp set 32 ends /10/cm , twill 2/1 and yarn count 12 Libra has achieved the best results after and before treatment by radar analysis, so it is the ideal sample (samples No.1)

Table (19) tabulate F-test and critical F-test for the effect fabric structure and number of picks /cm on fabric weight

The variables	P-value	Tabulate F-test	Critical F-test
Fabric structure	0.0000	43307.95	3.238867
Number of picks /cm	0.0000	121.1563	4.493998
Interaction	0.031726	3.781378	3.238867

Table (20) tabulate F-test and critical F-test for the effect yarn count and number of picks /cm on fabric weight

The variables	P-value	Tabulate F-test	Critical F-test
Yarn count	0.0000	929277.28	3.238867
Number of picks /cm	0.0000	161254.3	4.493998
Interaction	0.0000	886.7946	3.238867

Table (21) tabulate F-test and critical F-test for the effect of fabric structure and yarn count on fabric weight

The variables	P-value	Tabulate F-test	Critical F-test
Fabric structure	0.0000	55079.05	5.317645
Yarn count	0.0000	8234.149	5.317645
Interaction	0.0000	6188.944	5.317645

Before treatment	**Y=5.7367X+121.1**	**R= 0.9991288**
After treatment	**Y=1.9226X+1949.5**	**R=0.81557068**

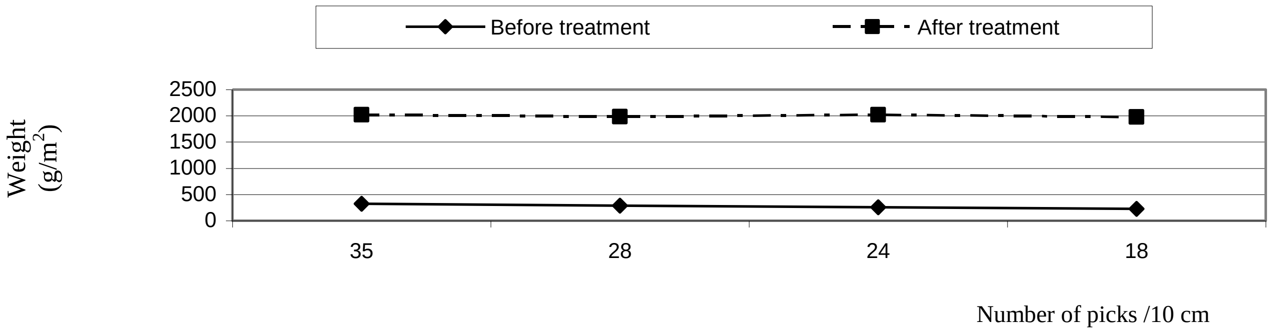

Fig (17
The relationship between number of picks /cm and weight, at yarn count 9 Libra , and irregular 2/1

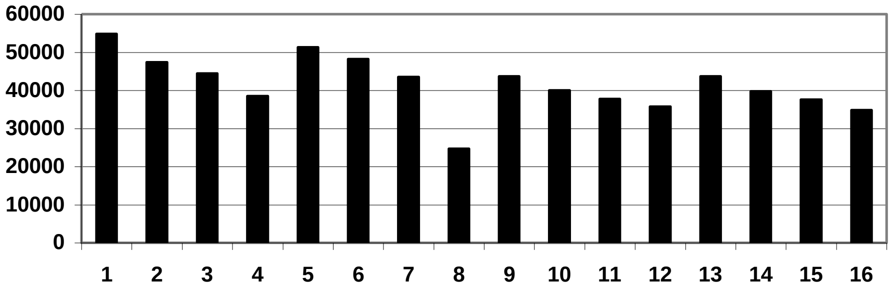

Fig (18)

Determination of the ideal samples by radar analysis (before treatment)

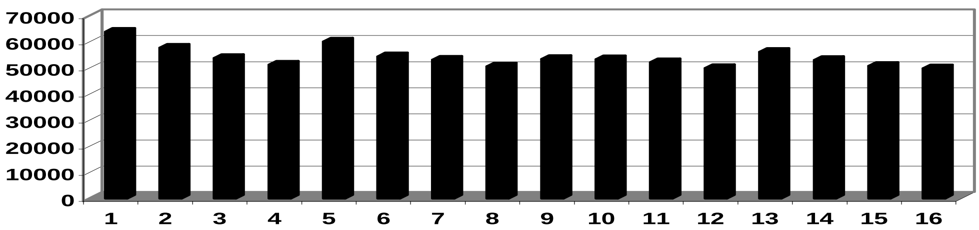

Fig (20)
Determination of the ideal samples by radar analysis, after treatment

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