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Study on Effect of Picks per Inch on Fabric Properties

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Abstract

Woven fabric end uses can be roughly divided into industrial, household and apparels. Fabrics projected for apparels have more emphasis on their appearance and handling characteristics such as lustre, smoothness or roughness, stiffness or limpness and draping qualities. In this research paper mainly focused on air permeability, tear strength and flexural rigidity were taken into consideration. In the present work observations are made by changing the pick density in the plain woven cotton fabric.

Key words: ***Air permeability, Tear strength, Flexural rigidity, Pick density.***

I. Introduction

Air permeability: [1] It is the one of the comfort property. The air permeability of a fabric is a measure of how well it allows the passage of air through it. Five specimens are used each with a test area of 508mm2 (25.4mm diameter) and the mean air flow in ml per second is calculated from the five results. From this the air permeability can be calculated in ml per 100mm2 per second. ***Tear strength:*** A fabric tears when it is snagged by a sharp object and the immediate small puncture is converted into a long rip by what may be a very small extra effort. It is probably the most common type of strength failure of fabrics in use. It is particularly important in industrial fabrics that are exposed to rough handling in use such as tents and sacks and also those where propagation of a tear would be catastrophic such as parachutes. Outdoor clothing, overalls and uniforms are types of clothing where tearing strength is of importance. The ***Flexural rigidity*** of fabric's bending stiffness is important for both consumer and industrial applications of fabrics. Stiffness is one of the most widely used parameters to judge bending rigidity and fabric handling. Md. Mahbubul Haque, [2] has studied effect of weft parameters on weaving Performance and fabric properties from their study, they observed that, the cover factor which is related to both P.P.I. and weft count and has significant effect on the weaving performance. It was observed that when the count as well as threads/inch of one series of yarn changes the crimp% i.e. the consumption of both series of yarns are affected. It was also observed that, as expected, when the threads/inch increases the fabric strength also increases but at higher threads/inch the gain in strength is relatively more. Noman Haleem et al., [3] has studied "Predicting the Air Permeability of Polyester/Cotton Blended Woven Fabrics", results shows that, Air permeability of the polyester/cotton blended woven fabrics has been predicted using response surface regression. The surface plots of input variables on the air permeability showed that ends and picks density of the fabrics play a vital role in deciding the air permeability of woven fabrics. Also the warp and weft linear densities are secondary parameters that help decide the air permeability of woven fabrics. Fabric thickness, areal density and cover factor do not hold a significant importance in predicting the air permeability of woven fabrics because of their dependence on the basic fabric geometry characteristics. R. Tugrul,[4] has studied the air permeability of woven fabrics, in his study, the theoretical model can be used to calculate the air permeability of woven fabrics. The construction factors and finishing techniques affects the air permeability. It is influenced by several factors such as the type of fabric structure, the design fabric density, the amount of twist in yarns, the size of the yarns, the size of the yarns, type of yarn structure, and size of the interstices in the fabric. It can be seen that, when the number of filling yarns per centimeter increases, the air permeability of the woven fabric decreases. Selin hanife eryuruk et al,. [5] had studied the effect of weave construction on tear strength of woven fabrics, from their study they used two different weft yarns were used to produce woven fabrics with three different weft densities while the warp density was kept constant. They concluded that, as parallel to the findings of earlier researchers, yarn density is found to be the most important parameter that significantly influences the tearing strength of the fabrics for all of the weave types. Mehmet emin YUKSEKKAYA et al,. [6] have studied the Influence of The Fabric Properties On Fabric Stiffness For The Industrial Fabrics. From their analytical study they found that the number of warp and filling yarns had an inverse relationship with the forming fabric flexural rigidity. Gadah Ali Abou Nassif [7] has studied Effect of Weave Structure and Weft Density on the Physical and Mechanical Properties of Micro polyester Woven Fabrics. From the study conclusions were drawn, as the weft density increases fabric air permeability and tearing strength decreases. Satin fabrics have the highest air permeability and tearing strength. Where-as plain fabrics have the lowest air permeability and tearing strength. The increase in weft density leads to an increase in crease angle and fabric stiffness. - Plain fabric showed higher fabric stiffness, while twill fabrics exhibited higher crease recovery. In the present work fabric air-permeability, tearing strength and stiffness is measured in the plain woven fabrics. Fabric samples were produced with different weft densities and tested the all samples with standard procedures.

II. Material and Experimental plan

In the present study cotton plain woven fabric is produced with the given combinations (Table 1). Here, all factors are kept constant and tested fabric properties by changing the pick density (i.e. Picks Per Inch).

Table 1: Factor and Levels used in one way ANOVA

Sl. No	Warp count (Ne)	Weft count (Ne)	EPI	PPI

1	40	40	128	68
2				73
3				80
4				85
5	60	60	112	96
6				101
7				109
8				117

In this way 4 different combinations of plain woven fabrics were prepared in the sequence for particular warp and weft counts. The Toyota air jet machine was used to prepare the fabric samples.

III. Result & Discussion

Air-permeability and Tear strength result of plain woven fabrics and Flexural rigidity result of plain woven fabrics results shown in (Table 2 & Table 3)

Table 2: Air-permeability and Tear strength result of plain woven fabrics

Sl. No	Warp count (Ne)	Weft count (Ne)	EPI	PPI	Air-permeability CC/SEC/CM2	Tear strength	
						Warp (gf)	Weft (gf)
1	40	40	128	68	311.1111	985.6	1971.2
2				73	207.7778	1049.6	1612.8
3				80	117.7778	947.2	1433.6
4				85	81.6667	998.4	1305.6
5	60	60	112	96	888.8889	1100.8	1344
6				101	772.2222	908.8	1267.2
7				109	702.7778	960	1100.8
8				117	627.7778	908.8	1049.6

Table 3: Flexural rigidity result of plain woven fabrics

Sl. No	Warp count (Ne)	Weft count (Ne)	EPI	PPI	warp way bending length (cm)	weft way bending length (cm)	warp way flexural rigidity (mg.cm)	weft way flexural rigidity (mg.cm)	overall flexural rigidity (mg.cm)
1	40	40	128	68	2.46	2.26	199.485	154.679	175.659
2				73	2.42	2.17	195.580	141.013	166.070
3				80	2.37	2.05	191.694	124.058	154.211
4				85	2.27	1.92	171.947	104.045	133.754
5	60	60	112	96	2.22	1.83	97.375	54.544	72.878
6				101	2.16	1.77	91.707	50.462	68.027
7				109	2.1	1.67	89.832	45.177	63.705
8				117	1.98	1.6	77.624	40.960	56.387

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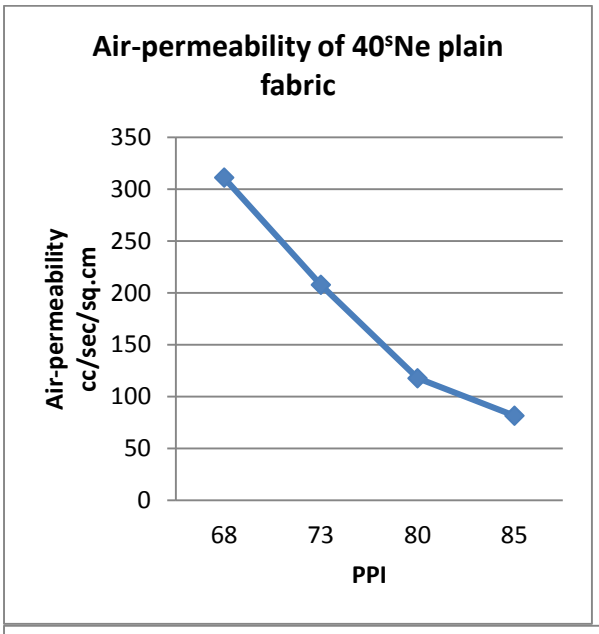
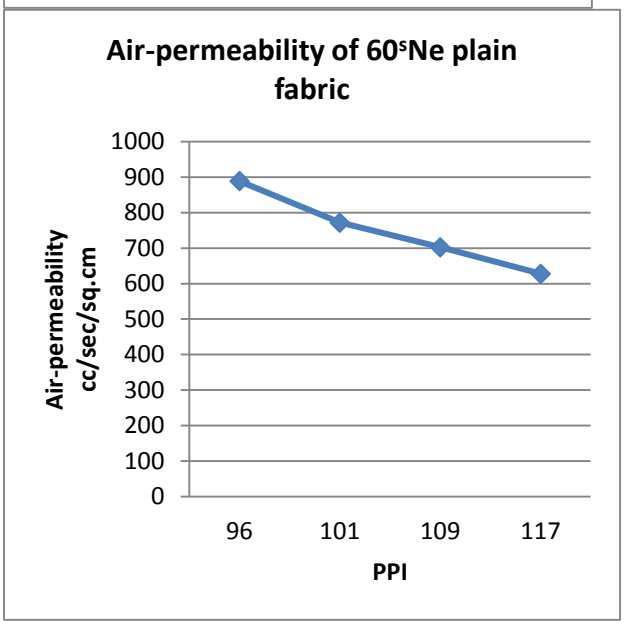
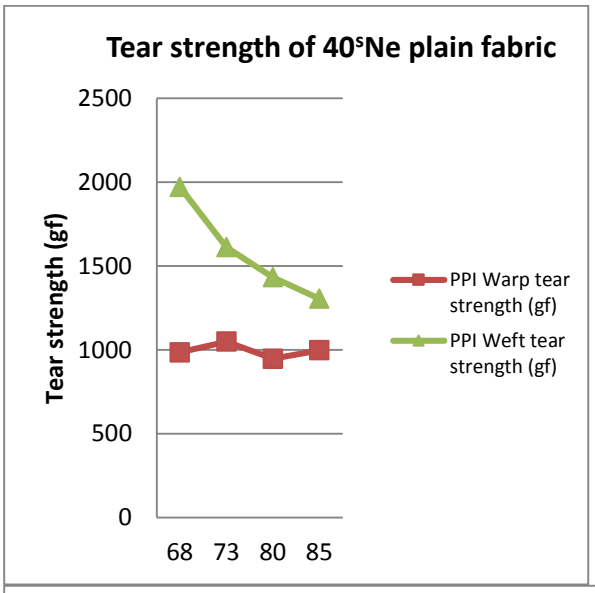
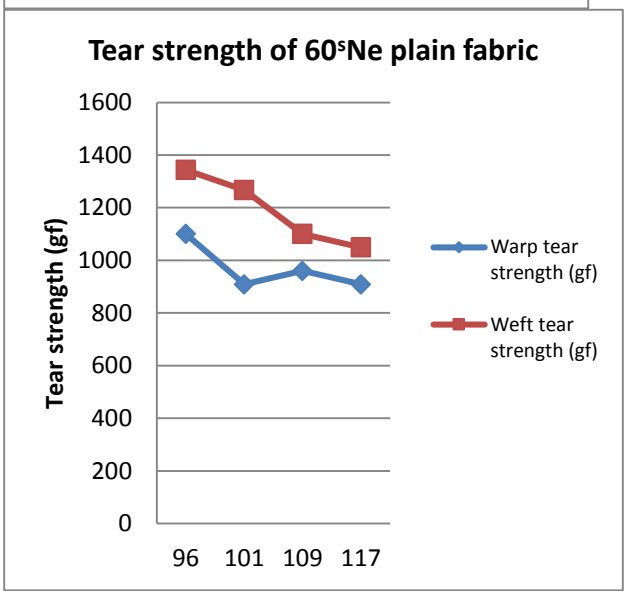


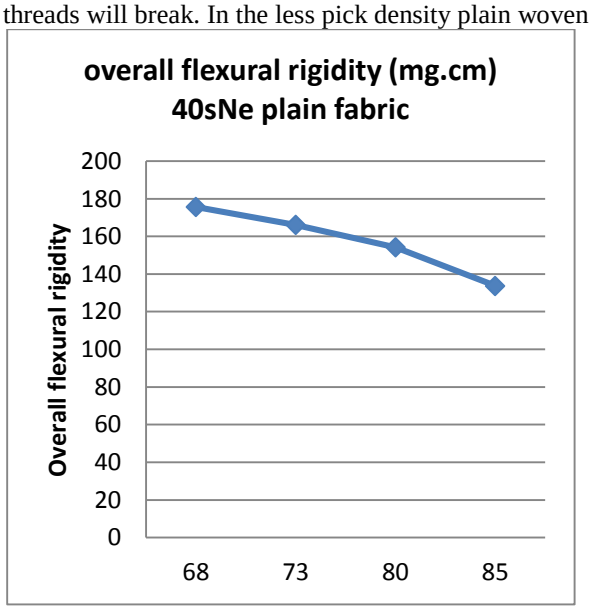


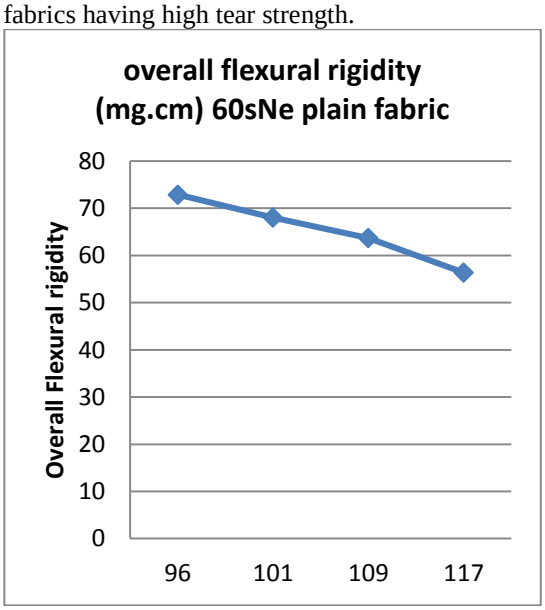
Air-permeability of plain woven fabrics are decreases with increasing the picks per inch in the fabric. While increasing the picks per inch (pick density) fabric cover factor is increases, due to more threads with-in the specified area air is resisted to flow through the fabric. As the fabric picks per inch increased, the fabric air permeability decreases.





As per the tear strength of plain woven fabric decreases with increasing the pick density. In the testing of samples it is observed that tearing will occur when threads in the tearing direction will first slip and grouped together then threads will break. In the less pick density plain woven fabrics having high tear strength.





Result shows that there is a significance effect between PPI and flexural rigidity. The deflection versus overhang length of the specimens, overall flexural rigidity decreases while increasing the filling density.

IV. Conclusion

From the above analysis it is concluded that the fabric properties are effecting by changing any one parameter of the fabric. Air-permeability of plain woven fabrics are decreases with increasing the picks per inch in the fabric. As per the tear strength of plain woven fabric decreases with increasing the pick density. Overall flexural rigidity of the fabric is decreases with increasing the pick density on the fabric.

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