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Studies on Drape Time Dependency and Relating It to Other Fabric Properties

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Abstract: The time dependency of node parameters like nodal length and nodal distance has been studied. Aesthetic properties encompass draping, stiffness and recovery properties of fabrics and they also have a significant influence on each other. It is also known that grey fabrics on being chemically treated tend to exhibit a change in their physical, mechanical, aesthetic and transmission properties. The work reports the time dependency of different union fabrics prior to and post their washing treatment. Time dependency assessment has been done on the basis of changes in the node parameters for all fabric samples. Regression equations have been developed showing relation between aesthetic properties which include bending length, total crease recovery angle, nodal parameters and structural property of fabric for a particular blend.

Keywords: time dependency, node parameters, PC union fabric, washing treatment.

I. INTRODUCTION

Drape is a unique property that allows a fabric to be bent in more than one direction describing a sense of graceful appearance [1-3]. Fabric drape is the ability of a fabric (circular specimen of known size) to deform when suspended under its own weight in specified conditions [4-6]. Fabric drape along with lustre, colour, texture, etc. defines fabric and garment appearance. Total appearance value has been correlated to crease retention, drape and formability (3). Studies regarding the change in picks per inch, blend proportion, dyeing and number of seams on drape coefficient has also been reported (7). Further drape and node parameters were used to describe its relation with other properties like gsm (gram/sq.mt), end per inch, picks per inch, thickness, bending length, flexural rigidity, bending modulus [8-10].

The properties of fabrics are largely influenced by different wet treatments given to it and washing treatment with mild alkali forms a very important part of textile processing and hence for time dependency study change in node parameters before and after washing has been reported for which one cotton union fabric, three P/C union fabrics and one polyester union fabric have been considered. Since fabric appearance is due to complex interaction between bending, creasing and draping behaviour, relating them would be interesting. Therefore it is also attempted to relate total crease recovery angle with bending length, node parameter and fabric weight per unit area by regression analysis.

II. MATERIALS AND METHODS

The fabric samples were procured from market in various blend proportions of polyester and cotton. The properties were tested for pre-washing as well as post washing treatment given to fabric in the different blend ratios considered. As far as drape coefficient, bending length and crease recovery measurement is concerned; their estimate has been obtained by using BTRA drapemeter, Shirley stiffness tester and Shirley crease recovery tester respectively. It has already been established that the Cusick's drape meter can be used for time dependency studies since it enables the measurement of drape coefficient using the same draped fabric sample. This data becomes an effective tool to understand the relaxation behaviour of the fabric when hung freely. The time dependence of the drape coefficient was worked initially by Chu et.al [11]. Later, Vengheluwe and Kiekens [12] measured time dependence of drape and their data showed that the drape coefficient decreased smoothly with time. This happened due to the slippage between the

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warp and weft threads under the influence of gravity. Jeong and Philip [13] measured the same by image-analysis method and found that there was slight decrease in the drape coefficient of fabric with time. The nodal parameters like nodal length and nodal distance have been found out by adopting the method discussed in earlier paper [8-10]. In the present study, time interval of 10 min was decided for time dependency study and three such readings have been taken for each fabric. For washing treatment, the fabrics were soaked in 2% concentrated water with the use of detergents at 100° C for 1 hour.

III RESULTS AND DISCUSSION

A Time dependency:

Pre-washing results:

Table 1: aesthetic properties of different union fabrics

Unwashed Fabric Samples										
	Drape Coefficient						Bending length in cm		Crease recovery angle	
SAMPLE NO.	10 min.	20 min.	30 min.	No. of nodes	Nodal Length in cm	Nodal Distance in cm	warp	weft	Warp	Weft
100% POLYESTER	50.27	47.88	47.88	5	12.42	14.52	3.35	2.64	122	126
67:33 - PC Blend	91	75	69	4	13.4	18.925	2.6575	2.3225	98.2	98.6
50:50-PC Blend	57.97	53.44	53.44	5	12.64	15	1.885	2.39	117.2	110
33:67-PC Blend	38.33	34.58	30.77	6	11.2	11.2	2.02	1.97	111.5	123.6
100% COTTON	77.95	74.45	71.93	4	13.075	18.625	3.625	2.905	65	51.4

Post-washing results:

TABLE 2 aesthetic properties of different union fabrics

Washed Fabric Samples										
	Drape Coefficient						Bending length in cm		Crease recovery angle	
SAMPLE NO.	10 min.	20 min.	30 min.	No. of nodes	Nodal Length In cm	Nodal Distance In cm	warp	weft	Warp	Weft
100% POLYESTER				6	12.4	11.54				
67:33 - PC Blend	89.251	78.334	60.98	4	13.53	18.33	2.65	2.54	117	113.2
50:50-PC Blend	57.58	52.68	51.55	6	12.13	12.38	1.9925	2.165	107.2	120
33:67-PC Blend	60.6	53.12	53.12	6	12.2	12.84	2	1.58	127.2	118.8
100% COTTON	95.31	93.8	89.27	4	13.68	19.13	3.835	3.86	100.6	101.8

Table 1 & 2 show result of change in the three important aesthetic properties of the union fabrics considered for the discussion respectively.

1) Nodal length and time: Figures 1a and b are plots of time and nodal length for unwashed and washed union fabrics respectively. The unwashed fabrics appear in a cluster form while after the washing treatment, the individual properties of the blend become more prominent. But the trend observed remains same that is, the nodal length decreases with time. 100% cotton fabrics show a decrease in nodal length with time before washing and after washing, P:C (33: 67 and 50:50) show a better decreasing trend after washing, while P:C (67:33) shows a clear cut decreasing trend irrespective of the whether washed or unwashed. 100% polyester fabric after washing shows almost equal decrease with time while unwashed fabric shows greater decrease in the last half of the time period considered. With reference to the blends, this would imply that as the proportion of cotton reduces trend seems to improve and so is the case with washing. The line fitted equations show R square value of ≥ 0.5 in each of the case whether washed or unwashed and for all blends considered. It has already been established that the behavioural pattern of drape coefficient and nodal length are similar (7, 9, and 10) that with time just as the drape coefficient reduces with time so does the nodal length. This is probably due to the relaxation of the component yarns. Amongst the un washed fabrics, 100% cotton shows clear cut reduction

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in nodal length, whereas in the union fabrics, as the proportion of cotton reduces the trend improves, while 100% polyester unequal change in the nodal length is observed with time.

After washing the trend is same, but clarity of behaviour improves especially in case of 33:67 p/c union fabrics. Even 100% polyester fabric shows almost equal reduction in nodal at the three different time intervals chosen.

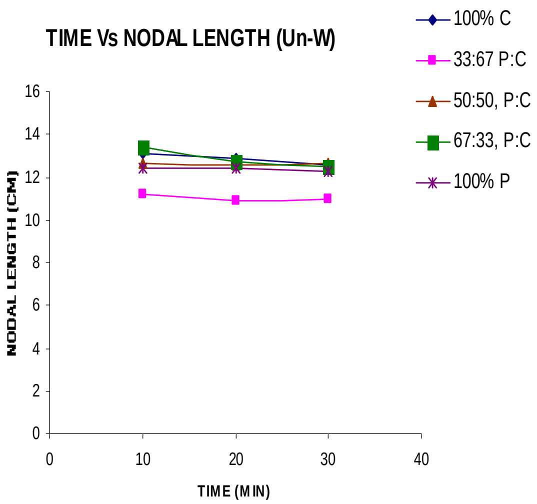

Figure 1a

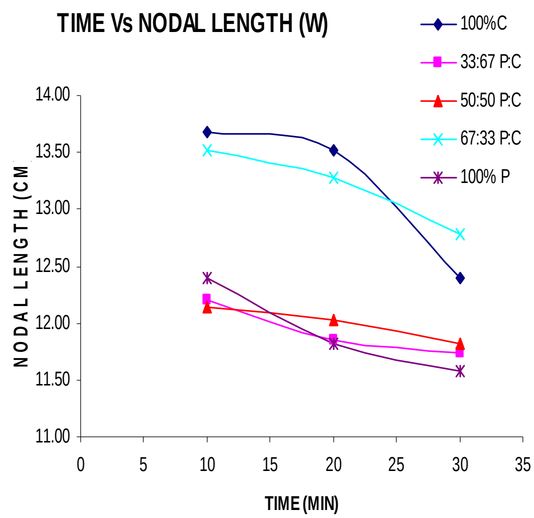

Figure 1b

2) Nodal distance and time: The figure 2a and b show the plot of change in nodal distance with time for the different union fabrics studied.

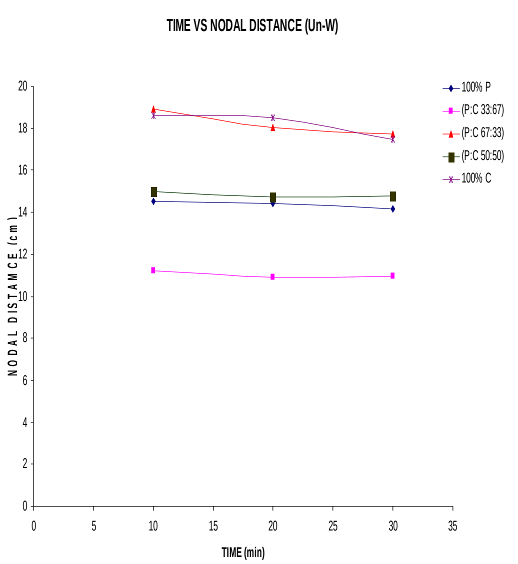

Figure 2a

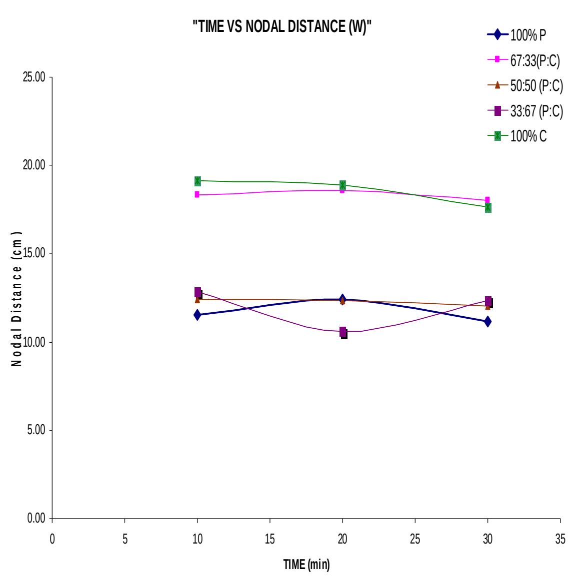

Figure 2b

The line fitted equations show R square value of ≥ 0.5 in each of the case whether washed or unwashed and for all blends. All the unwashed fabric samples show a decrease in nodal distance with time except 33:67 and 50:50 P/C union fabrics, a marginal increase in nodal distance is observed. In comparison to this the washed samples show a completely different behaviour. 100%, 100%P and P: C 67:33 show the same trend of increasing and then decreasing nodal distance while 33:67 P: C shows a decrease initially and then increases while 50:50 P: C shows a clear cut decrease in nodal length with time. Thus the behaviour is not quite predictable since a definite trend is not observed, which is reflected in terms of the correlation between the nodal length and nodal distance. In case of 100% cotton and 100% polyester fabrics the correlation goes on improving with time but is less than ≤ 0.5 in case of cotton and ≥ in case of polyester. in case of 33:67 & 67:33 P:C union fabric, the correlation improves in the first two time intervals and is greater than 0.5 (for 10 and 20 min) but then drops lower than 0.5 in the last time interval selected (30 min). 50:50 P: C shows improvement in correlation with time.

B Relating aesthetic properties using multiple regression analysis:

Multiple regression analysis was done to establish relation between node parameters like nodal length, nodal distance and number of nodes worked for 100% cotton sample after ten, twenty and thirty minutes and has been shown in equations 1-3 (unwashed) and equations 4-6 (washed) respectively.

Nodal length = 15.6156 – 0.1364 nodal distance + 0 * no. of nodes. *Eq. 1*

Nodal length = 22.1– 0.494 nodal distance + 0 * no. of nodes. *Eq. 2*

Nodal length = 12.18– 0.0226 nodal distance + 0 * no. of nodes. *Eq. 3*

Nodal length = 15.36552– 0.0084 nodal distance + 0 * no. of nodes. *Eq. 4*

Nodal length = 18.70272– 18.70272 nodal distance + 0 * no. of nodes. *Eq. 5*

Nodal length = 18.14108– -0.32574 nodal distance + 0 * no. of nodes. *Eq. 6*

It is clear from the above that the number of nodes can not be considered as a strong parameter when compared to the other drape parameters. The total appearance of the fabric is the complex interaction between various aesthetic properties and they have both independently and together, been related to node parameters and weight per unit area (gsm) of fabric. Since creasing is an important factor related to fabric appearance, other properties have been found in its terms by carrying out multiple regression analysis. Equations 7 and 8 show relation between bending length (B.L), node parameters and gsm, while equations 9 and 10 show the total crease recovery angle (T.C.R.A) in relation to node parameters, bending length and gsm for unwashed and washed respectively. Total crease recovery angle has been taken as the sum of warp and weft crease recovery angles and these equations have been developed for 100% cotton union fabrics. Similarly it would be possible to establish equations for other union combinations also.

B.L = -2.74946+0.107779 gsm -0.18004 nodal length-0.056 nodal distance *Eq. 7*

B.L = 204.3059 -2.18056 gsm +0.808831 nodal length -0.14677 nodal distance *Eq. 8*

T.C.R.A = 105.4 + 1.079663 gsm -2.76785 nodal length -1.15661 nodal distance + 24.0628 B.L *Eq. 9*

T.C.R.A = 4468.75 -47.706 gsm +33.45338 nodal length-1.89482 nodal distance – 0.267 B.L *Eq. 10*

IV.CONCLUSION

Drape is a very subjective property for describing the aesthetics of a fabric. It is been observed that nodal length and nodal distance are time dependent properties. With increase in time their values decreases. All considered blended fabrics follow this trend almost in totality and is maintained even after giving washing treatment to these fabrics. The multiple regression analysis has enabled successful computation of all aesthetic properties and the weight per unit area of the fabric. Thus will be possible to predict nodal length, bending length or total crease recovery angle from the above equations for the know variables.

REFERENCES

1 Ashok A Itagi, Arindam Basu,"Drape Behaviour of Silk Apparel Fabrics with Radial Seams",International Journal of Engineering Research and Technology",Vol.1,Issue-8,Oct 2012.

2 B.K.Behera, Ajit Kumar Pattanayak,"Measuring and modeling of drape using digital image processing",International Journal of Fibre Research & Textile Research"Vol 33, , PP 230-238,Oct 2008.

3 B.K.Behera & Rajesh Mishra, "Effect of crease behavior, drape and formability on appearance of light weight worsted suiting fabrics" IJFTR, Vol. 32, , pp. 319-325 ,Sept 2007.

4 British Standards Institution. Textiles. Test methods for nonwovens. Determination of drapability including drape coefficient. London: BSI; 2008.

5 British Standards Institution. Textiles - Test methods for nonwovens - Part 9: Determination ofdrape coefficient. London: BSI; 1998.
6 British standards Institution. Method for the assessment of drape fabrics. London: BSI; 1973.
7 G Thilagavathi & V Natarajan, "Development of a method for measurement of fabric three-dimensional drape and studies on influencing factors" IJFTR, Vol. 28, pp. 41-49, March 2003.
8 S.A.Agrawal & D.A.Vasavda,"Three Dimensional Measurement of Drape", Journal of the Textile Association, pp 155-162, Nov-Dec 2009.
9 S.A.Agrawal," Height Dependency of Drape Parameters", International Journal of Engineering Research and Application, Vol. 3, Issue 5, pp.01-05, Sep-Oct 2013.
10 S.A.Agrawal," Node Parameters and Its Relation with Constructional and Bending Properties of PC Blended Fabric", International Journal of Engineering Research and Development, Volume 5, Issue 7 , PP. 61-66 ,January 2013
11 C.C.Chu,C,L.Cummings & N.A.Teixeira,"Mechanics of Elastic performance of Textile materials",TRJ, pp 539-548,1950
12 Vangheluwe L, Kiekens P."Time dependence of the drape coefficient of fabrics". INT J CLOTH SCI TECH; 5(5), pp5-8, 1993.
13 Y.J.Joeng"A study of fabric drape behavior with image Analysis part-I:Measurement,characteristics,Instability",JTI,pp 59-69,1998