DETAILED INVESTIGATION OF AIR VORTEX VISCOSE RAYON YARN CHARACTERISTICS AND ITS INFLUENCE ON FABRIC

S.Sundaresan[1],
G.Abinaya Parameswari[2], K.Santhosh kumar[3], T.Bala Murugan[4]
1.Assitant professor(SRG)/Textile Technology/Kumaraguru College of Technology, Coimbatore-49, email: shobsundar@gmail.com
2,3,4: B.Tech-Textile Technology/VIII semester/ KCT/CBE

Abstract

Vortex is a high-quality yarn with a rich combination of functional and fashionable features. Vortex is widely used for various apparel products and fabrics. In vortex spinning, one end of each fiber is anchored in the center of the yarn such that the center of the yarn is always without twist. The other fiber end forms the outer yarn layer in a 'true twist' arrangement. A new concept of "spin yarn with the vortex flow of compressed air" is adopted in vortex yarn spinning. The yarn construction principle is the same regardless of the fiber used. The vast majority of previous works deals with the properties of vortex spun yarn and the spinning system. In this study we developed the woven fabric using the combination of vortex yarn spun by using cotton, viscose and modal fibres. Different combinations in warp and weft directions are used to produce the woven fabric. The physical properties of the fabric are analyzed and the findings of the test were optimized.

Key words: *Vortex, Viscose rayon, Compressed air, true twist, Modal fibre*

---

1. Introduction

Air vortex technology is gaining momentum in spinning sector of the textile industry. This technology can be successfully used to produce the count range of 30's N_e to 60's N_e yarn with high quality. The vortex technology can be used to spun yarn using viscose staple fibre and modal fibre. The vortex yarn thus produced is made in to fabric using air jet loom. The fabric produced by using different warp and weft combination of vortex yarn. The fabrics are tested for its physical properties and the results are analyzed for finding the best combination which can be suited for bed sheeting fabric.

2. Methodology

The air vortex spinning machine is used to produce 30's, 34's N_e yarn , and ring spinning machine is used to produce 30's, 40's and 60's N_e yarn. The sample details of yarn is given in the table 2.1

Table 2.1 Yarn sample details

S.NO		CSP
1.	30'S VISCOSE VORTEX	2300

2.	**40'S VISCOSE VORTEX**	**2000**
3.	**34'S VISCOSE VORTEX**	**2400**
4.	**30'S VSF**	**2500**
5.	**30'S VSF HT**	**2500**
6.	**40'S VSF**	**2300**
7.	**40'S COTTON**	**2000**
8	**60'MODAL**	**2430**

The sample plan for producing the woven fabric is given in the table 2.2. Totally 12 samples are produced using air jet weaving machine and the code number is given in the table is followed during the entire study.

Table 2.2 sample code and specifications

S.No	Sample code	Warp count	Weft count	Ends/inch (EPI)	Picks/inch(PPI)
1	A1	30's VOR	30's VOR	68	60
2	A2	30's VOR	30's VOR	68	62
3	A3	30's VOR	30's VOR	112	74
4	A4	30's VOR	34's VOR	68	48
5	A5	30's VSF	30's VOR	68	62
6	A6	30's VSF	30's VOR	68	60
7	A7	30's VSF	30's VSF HT	56	44
8	B1	40's VSF	40's VOR	88	76
9	B2	40's VSF	40's VOR	88	72
10	C1	40's cotton	40's cotton	120	72
11	C2	60's Modal	60's Modal	90	86
12	C3	60's modal	60's modal	90	78

* VOR: Air Vortex spun yarn VSF: Viscose staple fibre. VSFHT: Viscose staple fibre yarn –High twist

3. Results and discussions

The fabric produces as per the experimental plan are tested for the following physical properties as listed below(table 3.1) and the results are given in table 3.2

Table 3.1 Test parameters

S.no	Test parameter	Test standard
1	Grams/square meter	ASTM D4850
2	Thickness of cloth	ASTM D1777 – 96
3	Abrasion resistance	ASTM D3885 - 07a
4	Bursting strength	ASTM D3786
5	Drape coefficient	9073-9 2008 ISO standard
6	Bending length	ASTM D1388
7	Flexural rigidity	ASTM D7748
8	Bending modulus	ASTM D747

9	Tearing strength	ASTM D1424
10	Tensile strength	ASTM D2261-13

Table 3.2 Test results

S.No	Sample code	GSM	Thickness (mm)	Abrasion resistance (Weight loss %)	Bursting strength Lbs/inch^2)	Drape coefficient
1	A1	116	0.16	15.38	140	0.956
2	A2	112	0.15	6.25	160	0.867
3	A3	160	0.18	5.5	200	0.891
4	A4	96	0.15	11.11	145	0.927
5	A5	116	0.15	18.18	155	0.980
6	A6	104	0.13	11.11	155	0.940
7	A7	76	0.16	10	120	0.819
8	B1	112	0.13	7.14	155	0.867
9	B2	108	0.12	7.14	150	0.956
10	C1	120	0.16	5	155	0.988
11	C2	76	0.06	10	145	0.887
12	C3	72	0.05	11.11	125	0.758

Table 3.1 Test results contd...,

S.No	Sample code	Stiffness Test				Tearing Strength	
		Bending length(cm)		Overall flexural rigidity(mg.cm)	Bending Modulus Kg/cm^2	Warp way	Weft way
		Warp way	Weft way			g.force	g.force
1	A1	6.45	3.05	$1012.15x10^4$	29652.8	1984	2240
2	A2	5.8	2.3	$5456.95x10^4$	194024.8	1856	2112
3	A3	5.45	3.65	$1419.56x10^4$	29209.05	2112	2208
4	A4	6.3	2.6	$636.42x10^4$	22628.26	1408	2176
5	A5	5.5	2.5	$1870.30x10^4$	66499.56	2048	2560
6	A6	4.75	2.8	$504.44x10^4$	27552.48	1952	2176
7	A7	6.35	2.6	$509.80x10^4$	14935.5	2624	2656
8	B1	4.45	2.65	$453.541x10^4$	24772.38	1792	2560
9	B2	4.45	3.125	$329.58x10^4$	38892.36	1216	1248
10	C1	3.9	2.3	$322.3x10^4$	9444.43	960	1920
11	C2	4.05	3.15	$346.30x10^4$	192388.8	1536	1856
12	C3	4.3	2.13	$199.572x10^4$	191587.2	1664	1664

Figure 3.1 GSM of fabric

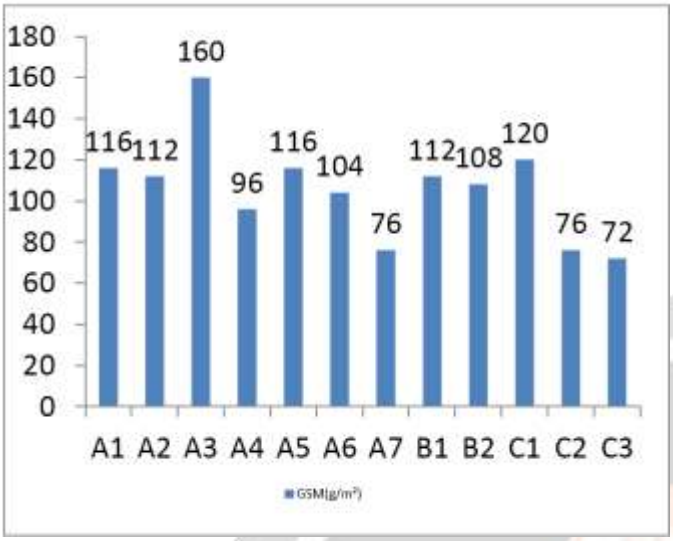


Figure 3.2 Thickness of fabric

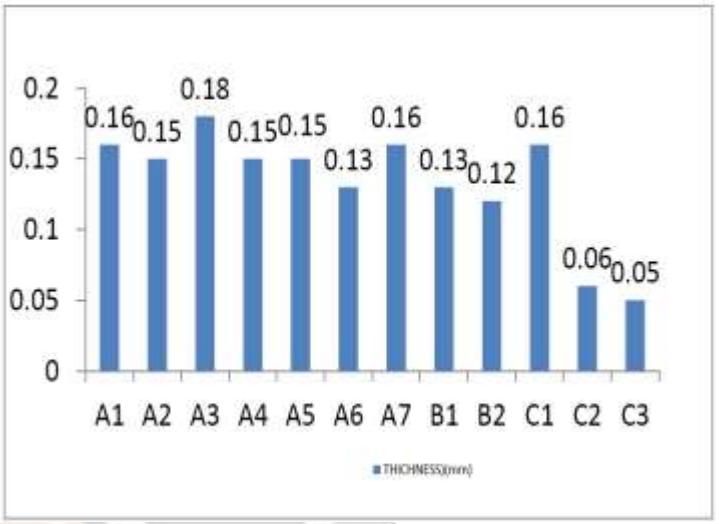


Figure 3.3 Abrasion Resistance of fabric

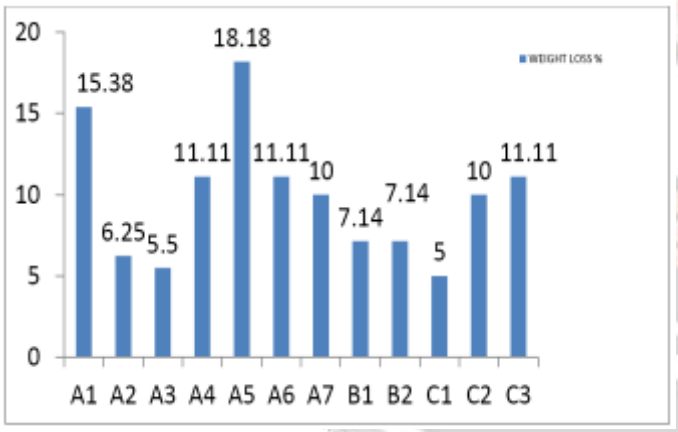


Figure 3.4 bursting strength of fabric

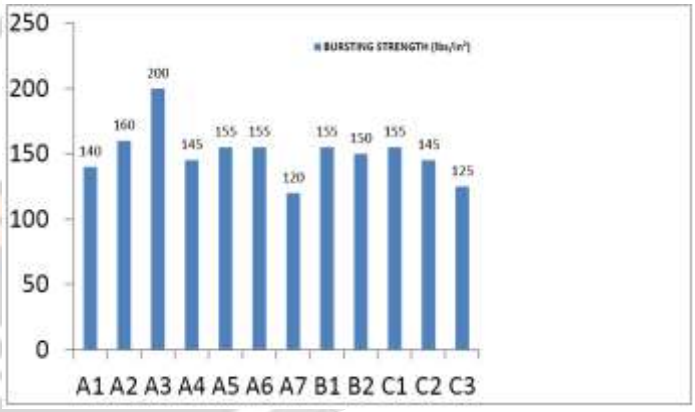


Figure 3.5 Bending modulus of fabric

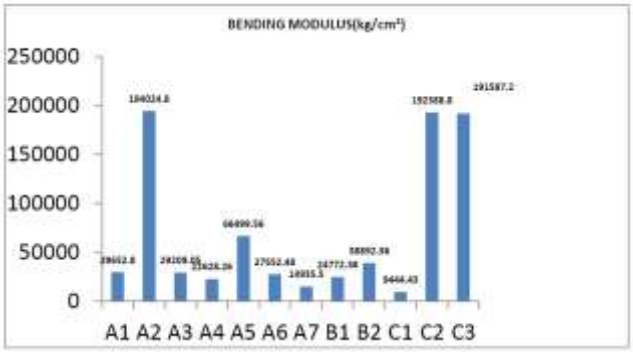


Figure 3.5 Flexural rigidity of fabric

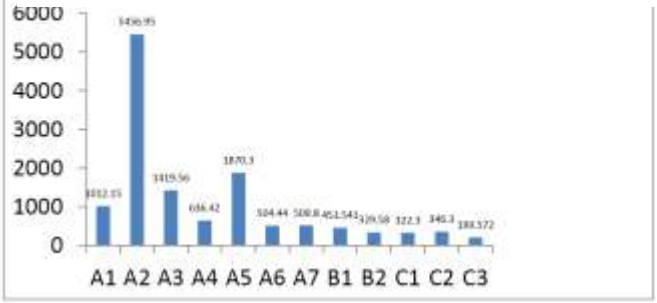


Figure 3.6 Tearing strength of fabric

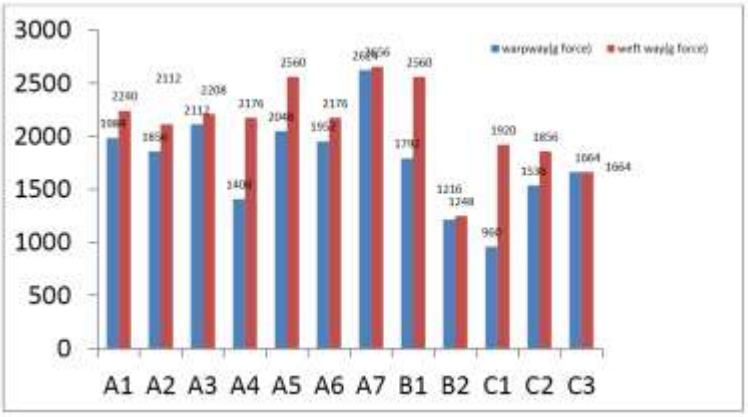
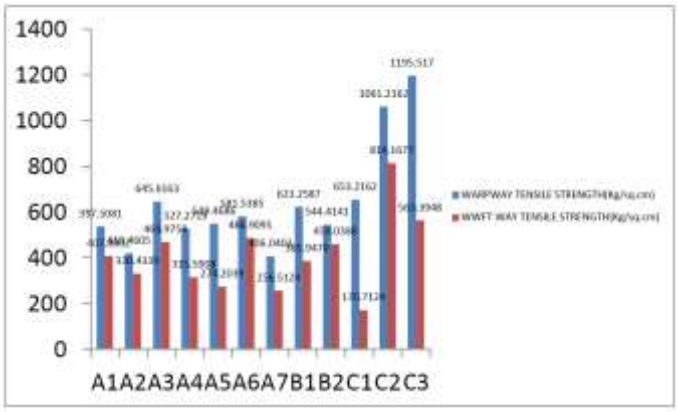


Figure 3.7 Tensile strength of fabric



Conclusion:

The fabric woven using air vortex yarn (warp and weft) exhibits a very good results in terms of abrasion resistance, tensile strength, bursting strength , drape and tensile strength.

The abrasion resistance of the fabric is 3 times higher for the fabric woven using air vortex yarn (warp and weft) compared with other fabric. This is due to the firmness of yarn due to air vortex spinning and also close compact packing of yarn during air vortex twisting.

The bursting strength of the woven fabric made air vortex spun yarn shows a terrible increase in the tensile strength of fabric. There is a 1.5 time increase in the tensile strength of fabric due to the yarn strength increase and the good cohesion property of air vortex yarn.

Finally the the fabric made using air vortex yarn shows good results in the physical properties of fabric which implies that the fabric has got more durability and serviceability.

References:

1. Rameshkumar C et al.. "Comparitive studies on ring rotor and vortex yarn knitted fabrics" AUTEX Research Journal, Vol. 8, No4, December 2008
2. Eva Moučková et al"Properties of viscose vortex yarns depending On technological parameters of spinning" AUTEX Research Journal, Vol. 15, No 2, June 2015
3. Guldemet Basal and William Oxenham "Vortex spun yarn vs. Air-jet spun yarn" AUTEX Research Journal, Vol. 3, No3, September 2003
4. Basal, G., and Oxenham, W., Effects of some Process Parameters on the Structure and Properties of Vortex Spun Yarn, Text. Res. J., 76(6), 492-499 (2006)
5. Ortlek, H.G. , and Ulku, S., Effect of Some Variables on Properties of 100% Cotton Vortex Spun Yarn, Text. Res. J., 75(6), 458-461 (2005)
6. Tyagi, G.K. , and Sharma, D., Low-stress Characteristics of Polyester-Cotton MVS Yarn Fabrics, Ind. J. Fibre & Text. Res., 30(March), 49-54 (2005)
7. Huseyin Gazi Ortlek, Levent Onal "Comparative study on the characteristics of knitted fabrics made of vortex-spun viscose yarns" Fibers and Polymers, April 2008
8. Ghada Ali Abou-Nassif "A Comparative Study between Physical Properties of Compact and Ring Yarn Fabrics Produced from Medium and Coarser Yarn Counts" Journal of Textiles, Volume 2014 (2014)

9. A. Mukhopadyhay et al "Thickness and compressional characteristics of air-jet textured yarn woven fabrics" International Journal of Clothing Science and Technology, Vol. 14 Iss: 2, pp.88 – 99
10. Esin Sarioğlu et al. "A Study on Physical Properties of Microfilament Composite Yarns" Journal of Engineered Fibers and Fabrics, Volume 11, Issue 3 – 2016