(REFEREED RESEARCH)

COMPARISON OF THE FASTNESS PROPERTIES AND COLOR VALUES OF COTTON FABRICS KNITTED FROM AIR-VORTEX AND RING SPUN YARNS

VORTEKS VE RİNG İPLİKLERİNDEN ÜRETİLMİŞ PAMUKLU ÖRME KUMAŞLARIN RENK DEĞERLERİ VE RENK HASLIKLARI AÇISINDAN KARŞILAŞTIRILMASI

Ali KİREÇCİ
Gaziantep University
Textile Engineering Department
e-mail: kirecci@gantep.edu.tr

Pınar PARLAKYİGİT ERDAL
Gaziantep University
Textile Engineering Department

Halil İbrahim İÇOĞLU
Gaziantep University
Textile Engineering Department

ABSTRACT

Ring spinning system is used to produce high-quality yarn, and a wide diversity of yarn styles, but suffer from a low productivity rate. On the other hand, the air vortex spinning is a promising method of new yarn spinning techniques due to its very high speed, but the yarn quality still needs to be investigated from different aspects. The purpose of the study is to compare the color fastness and colorimetric properties of air vortex and ring spun yarns to analyze the difference of these two yarns when only the dyeing properties of them are considered. Therefore, three reactive dyes were applied at different omf (on mass of fabric) depth of shade to the fabrics which are produced from air vortex and ring spun yarns. The results show that, in general, the color fastness values of the air vortex yarn are good as much as to that of ring spun yarn. Also, the examination of color coordinates of undyed and dyed samples on CIELAB color space show that L*, C* and K/S values of both fabrics are similar.

Key Words: Color values, Fastness, Air-vortex spinning, Cotton, Ring spinning.

ÖZET

Ring iplik eğirme sistemi, kaliteli ve çeşitli iplik türlerinin üretilmesine uygun olmasına rağmen düşük üretim hızına sahiptir. Diğer taraftan vorteks iplik eğirme sistemi, sahip olduğu yüksek üretim hızı sayesinde çok avantajlı bir yeni iplik üretim tekniğidir. Ancak, iplik kalitesi açısından bakıldığında hala çeşitli açılardan incelenmesi gerekmektedir. Bu çalışmanın amacı, sadece boyama özellikleri açısından ring ve vorteks iplikleri arasındaki farkın analiz edilmesinde bu ipliklerin renk değerlerinin ve renk haslıklarının karşılaştırılmasıdır. Bu amaçla, üç farklı reaktif boyarmadde ile 3 farklı renk derinliğinde vorteks ve ring ipliklerinden üretilmiş kumaşlar boyanmıştır. Sonuçta, genel olarak vorteks iplikleriyle üretilen kumaşların renk haslığı değerleri ring iplikleriyle üretilen kumaşlar kadar iyi çıkmıştır. Ayrıca CIELAB renk uzayındaki boyanmış ve boyanmamış numunelerin renk koordinatlarının incelenmesi ile her iki kumaşın L*, C* ve K/S değerlerinin benzer olduğu görülmüştür.

Anahtar Kelimeler: Renk değerleri, Haslık, Vorteks iplik eğirme, Pamuk, Ring iplik eğirme.

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1. INTRODUCTION

Ring spinning is a continuous spinning system in which twist is inserted into a yarn by a circulating traveller. The yarn twist insertion and winding action take place simultaneously by means of a rotating spindle. Ring spinning is the widely used conventional yarn spinning method because of improved yarn quality parameters, possibility of using various fibers and the wide range of yarn counts. Drawbacks of conventional ring spinning can be ordered as; lower production rates according to other spinning systems because of heat generation in the traveller at higher speeds, hairiness and yarn breakage due to spinning triangle and frictions. Because of these problems, new spinning methods gain importance nowadays.

One of the newest spinning methods is air-vortex spinning. The tip of the fiber is focused to the center of the yarn by the vortex of compressed air so that the center of the yarn is always made straight without twisted. The other tip forms the outer layer that twines another fiber. Since air-vortex spun yarn has the least hairiness as an advantage among all the types of spun yarn, air-vortex enables to create textiles with characteristics such as anti-pilling and anti-abrasion performance. Air-vortex's fiber structure itself is superior in moisture absorption and diffusion rate thus provides refreshing comfortableness (1). This method is the fastest method in comparison to other spinning methods. Spinning speed is quite high because there is no mechanical twist insertion device. And also air-vortex spun yarn is directly spun from draw frame sliver and it is very flexible that various types of fibers can be spun at any fineness. Furthermore range of yarn fineness of air-vortex spinning is similar to that of ring spinning.

With respect to the cost of investment, air-vortex spun yarns produced from sliver has no cost of a roving frame and winder. Also air-vortex spun yarn production rates can reach up to 450 meters per minute, approximately 3 times faster than rotor spinning and 20 times more productive than ring spinning, depending on yarn count. Additionally the less mechanical equipment means the less maintenance cost for air vortex spinning machines. Energy, space and human savings of air-vortex spinning can be ordered as approximately 30%, 50% and 55% as compared with ring spinning respectively (1).

Basal and Oxenham investigated the effects of some process parameters on the structure and properties of air-vortex spun yarn. The results showed that the short front roller to the spindle distance caused better evenness, low imperfections and less hairiness. High nozzle angle and high nozzle pressure, low yarn delivery speed and small spindle diameter reduced hairiness as well. High nozzle angle, high nozzle pressure and low speed also led to higher fiber migration. Surprisingly, nozzle angle, nozzle pressure or delivery speed did not have any significant effects on yarn tensile properties due to the relatively small differences between the levels of these parameters used in the trials (2).

Ortlek and Ulku examined the influences of various parameters on the properties of air-vortex spun yarns. Their results indicated that the delivery speed, nozzle pressure and yarn count were all significant parameters for yarn evenness, imperfections, hairiness and tensile properties (3).

Soe et al. examined the yarn structures, fiber arrangements, yarn diameter and yarn parameters such as tenacity, evenness, and hairiness of air-vortex spun yarns in comparison with ring and rotor spun yarns. The results showed that although the ring spun yarn has the highest tenacity, it has poor bending properties, bulkiness and hairiness values with respect to the air-vortex and rotor spun yarns (4).

Beceren and Nergis performed the study on comparison of some mechanical and physical properties of ring, compact and air-vortex spun cotton yarns. They showed that the structural differences of each yarn type conferred different tensile, evenness and hairiness values, and the differences in the yarn structure were reflected onto the fabric properties (5).

Basal and Oxenham performed a study to compare the physical properties of vortex and air-jet yarns produced from different polyester cotton blends. The results of the study indicated that vortex yarns have tenacity advantages over air jet yarns, particularly at high cotton contents (6).

Li et al. studied on the comparison of shrinkage properties of fabrics produced from Murata air-vortex spun yarn and worsted ring spun yarn. They found that after pressure steaming, all fabrics show similar levels of relaxation shrinkage and hygral expansion (7).

Ortlek and Onal compared the mechanical properties of fabrics which are produced from air-vortex, ring and open-end rotor spun yarns. The results of the study indicated that the shrinkage of fabrics from air-vortex spun yarn has the lowest value at widthwise direction, while having the highest at lengthwise direction. The fabric spirality and twist liveliness for yarns for different spinning systems are similar. On the other side the bursting strength of fabrics from air-vortex yarn is lower than that of those from ring spun but higher than that of those from open-end rotor spun yarn. It is also achieved that the fabrics from air-vortex spun yarn have the lowest pilling tendency and highest resistance to abrasion (8).

Omeroglu and Becerir made the comparison of color values of cotton fabrics woven from ring and compact spun yarns. They used Ne30, Ne40 ad Ne50 yarns and determined lightness, chroma and K/S values for both dyed and undyed fabric samples. According to this study, as the yarn counts increase, the lightness and chroma values increase but the K/S values decrease in dyed fabrics whereas the results are opposite in undyed fabrics. The highest numerical differences are obtained between the chroma values of the fabrics (9).

Becerir and Omeroglu examined color values of plain cotton fabrics knitted from ring and compact spun yarns. They compared the lightness, chroma and K/S values of dyed and undyed knit fabrics for three different yarn counts. They showed that fabrics knitted from ring-spun yarns appeared darker and more saturated in color (10).

The majority of the study in relation to air vortex spun yarn in the literature is about comparison of mechanical properties of air vortex and ring spun yarns as given above. In general, these studies indicate that some mechanical properties of air vortex spun yarns such as those pilling resistance, evenness, hairiness and bulkiness are comparable with that of ring and rotor spun yarn. However, the tenacity is not good as much as the tenacity of ring spun yarn but it is higher than that of rotor spun yarn. Interestingly, no study was found about the color fastness of air vortex yarn. This study aims the investigation of fastness values such as washing, rubbing, perspiration and light fastness of cotton fabrics which are knitted from air-vortex and ring spun yarns. Additionally, the colorimetric properties of these fabrics such as Lightness (L*), Chroma (C*), h (hue) and color strength (K/S) are also examined.

2. MATERIAL AND METHOD

Characteristics of the cotton for the yarn production which are used in the experimental study are given in Table 1.

Table 1. Characteristics of cotton fiber (HVI results)

Cotton fiber data	
Cotton type US Upland cotton	
Fineness (Micronaire)	4,0
Upper half mean length(mm)	29,7

In order to determine the tensile properties of these two types of yarns Uster® Tensorapid was used. Correspondingly, Uster® Tester 4 was used to determine the unevenness and hairiness values of the yarns. Table 2 represents mechanical and physical properties of the ring and air-vortex spun yarns.

Air-vortex and ring spun yarns were generously supplied by Muratec Textile Machinery. By using these yarns, single jersey fabric samples were knitted on the sample knitting machine in the laboratory conditions. Table 3 shows the knitted fabric properties. Then these fabric samples were dyed to three different colors at three different depths of shade. The reactive dyes and auxiliaries used in this study were kindly supplied by Huntsman International LLC. The dyes were arbitrarily chosen and used without purification.

Table 2. Characteristics of air-vortex and ring spun yarns

Yarn Data		
Yarn Type	Air-vortex	Ring
Yarn Kind	100% Cotton	100% Cotton
Yarn Count (Ne)	40,43	40,0
Strength (cN/Tex)	12,91	17,37
Elongation (%)	3,53	4,32
Unevenness (CV_m%)	13,7	12,51
Thin Places -40% (1km)	300	58,8
Thick Places +35% (1km)	280	268,8
Neps +200% (1km)	30	31,3
Hairiness (H)	3,87	4,17
Speed (m/min)	400	20

Table 3. Construction Properties of the knitted fabrics

Fabric Type	Thickness (mm)	Courses/cm	Wales/cm	Fabric weight (g/m^2)
The fabric knitted from air-vortex spun yarn	0,33	19	11	89,35
The fabric knitted from ring spun yarn	0,35	17	10	79,28

Table 4. Process conditions

Bleaching Recipe									
Peroxide	2 g/L								
NaOH	1.5 g/L								
Wetting Agent (Exowet)	1 g/L								
Sequestering agent(Antisil Conz)	0.25 g/L								
Egalizator (Exolube NC)	1 g/L								
Liquor ratio	1/50								
Reactive Dyeing									
	Concentration values								
Novacron Dyes	Blue FN-R (VS/MFT based)			Red FN-3G (VS/MFT based)			Yellow FN-2R (VS/MFT based)		
Ring based fabric	0.5%	1%	2%	0.5%	1%	2%	0.5%	1%	2%
Air-vortex based fabric	0.5%	1%	2%	0.5%	1%	2%	0.5%	1%	2%
Salt	30g/L	40g/L	50g/L	30g/L	40g/L	50g/L	30g/L	40g/L	50g/L
Sodium Carbonate	8g/L	8g/L	11g/L	8g/L	8g/L	11g/L	8g/L	8g/L	11g/L
Acetic Acid	0.8 g/L								
Liquor ratio	1/50								

2.1. Dyeing process

Initially, the fabric samples were bleached at 95°C and 30 minutes, according to the bleaching recipe given in Table 4. All dyeings were carried out in sealed stainless steel dye pots housed in a laboratory scale dyeing machine. All dyes are vinylsulphone-monofluorotriazine (VS/MFT) based reactive azo dyes. The dyes were applied by using the manufacturer's recommendations as given in Table 4. And also the dyeing method is shown in Figure 1. At the beginning of the dyeing process, sample fabrics and required amount of dye solution were put into the dye pots. The required amount of salt and sodium carbonate were added 10 minutes and 45 minutes after from the beginning of dyeing respectively. The whole dyeing process was taken up 90 minutes. After dyeing, 10 minutes rinsing at 50°C, 10 minutes neutralization at 50°C, 15 minutes washing at 90°C, 10 minutes rinsing at 50°C and 10 minutes cold rinsing were applied to the samples.

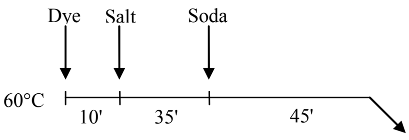

Fig. 1. Dyeing method

2.2. Color fastness tests

Washing, rubbing, perspiration and light fastness tests were applied to both ring and air-vortex based fabrics according to the test methods of ISO 105/C06 A2S (40 °C); ISO 105:X12; ISO 105-E04 and ISO 105 B02 respectively (11-14). The grey scale was used for color change and for staining. SDC® multifiber strip fabric as an adjacent material was used at perspiration and washing fastness tests. Generally, the results show that the washing, perspiration and light fastness of both fabrics are very good however the numerical values of air-vortex spun yarn are slightly better than ring spun yarn. Rubbing fastness results of air-vortex are better than ring spun yarn.

2.3. Color Measurement

Color measurement was carried out using a reflectance spectrophotometer (Hunterlab Colorquest II) coupled to a PC between 400nm and 700nm wavelengths with 20nm intervals under illuminant D65/10° standard observer with the specular component included. Each fabric was folded four times and four readings were performed by rotating 90° clockwise after each reading. For the undyed samples (bleached) CIE WI values were determined. For the dyed samples, CIELAB coordinates (L*, a*, b*, C*, h) and K/S values were calculated as the reflectance values by the software of the spectrophotometer. K/S values were recorded at wavelength of maximum absorption (for yellow: 440nm, for blue: 620nm, for red: 520nm). Average of three readings was taken.

Table 5. Washing fastness results of samples produced from air-vortex spun yarns

Depth of shade	Dye	Fading	Staining					
			Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
0,5%	Yellow	5	5	5	5	5	5	5
	Red	5	5	5	5	5	5	5
	Blue	5	5	5	5	5	5	5
1%	Yellow	5	5	5	5	5	5	5
	Red	5	5	5	5	5	5	5
	Blue	5	5	5	5	5	5	5
2%	Yellow	5	5	5	5	5	5	5
	Red	5	4/5	5	5	5	5	5
	Blue	5	5	5	5	5	5	5

Yellow : Yellow FN-2R; Red : Red FN-3G; Blue: Blue FN-R

Table 6. Washing fastness results of samples produced from ring spun yarns

Depth of shade	Dye	Fading	Staining					
			Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
0,5%	Yellow	5	5	5	5	5	5	5
	Red	5	5	5	5	5	5	5
	Blue	5	5	5	5	5	5	5
1%	Yellow	5	5	5	5	5	5	5
	Red	5	5	5	5	5	5	5
	Blue	5	5	5	5	5	5	5
2%	Yellow	5	4/5	5	5	5	5	5
	Red	5	4/5	5	5	5	5	5
	Blue	5	5	5	5	5	5	5

Yellow: Yellow FN-2R; Red: Red FN-3G; Blue: Blue FN-R

3. RESULTS AND DISCUSSION

3.1. Evaluation of washing fastness

The washing fastness results of the reactive dyed fabrics knitted from ring spun and air-vortex spun yarns are slightly different as seen in Table 5 and Table 6. It has also been observed that yarn production method has no effect on the washing fastness of the fabrics according to used three different reactive dyes at three different depths of shade.

3.2. Evaluation of rubbing fastness

Dry rubbing fastness values of air-vortex spun samples are slightly better than ring spun samples as shown in Table 7. However, wet rubbing fastness values of air-vortex samples are much better than that of ring spun samples as shown in Table 8. In addition, wet rubbing fastness values decrease considerable for ring and air-vortex samples as depth of shade increases. Higher hairiness of ring spun yarn may be the main reason lower rubbing fastness values because the hairs are first removed under abrasive forces.

3.3. Evaluation of perspiration

Table 7. Dry rubbing fastness results of samples produced by ring and air-vortex spun yarns

Depth of shade	0,5%			1%			2%		
Dye	Yellow	Red	Blue	Yellow	Red	Blue	Yellow	Red	Blue
Air-vortex	5	4/5	5	4/5	4/5	4/5	4	4/5	4/5
Ring	5	4/5	5	4/5	4	4/5	4	4	4

Table 8. Wet Rubbing Fastness results of samples produced by ring and air-vortex spun yarns

Depth of shade	**0,5%**			**1%**			**2%**		
Dye	Yellow	Red	Blue	Yellow	Red	Blue	Yellow	Red	Blue
Air-vortex	5	4	5	4	3	4/5	3/4	2/3	3/4
Ring	4/5	3	4/5	4	2/3	4/5	3	2	3/4

Table 9. Acid perspiration fastness results of samples produced from air-vortex spun yarns

Depth of shade	**Dye**	**Fading**	**Staining**					
			Acetate	**Cotton**	**Nylon**	**Polyester**	**Acrylic**	**Wool**
0,5%	Yellow	5	5	4/5	5	5	5	5
	Red	5	5	4/5	5	5	5	5
	Blue	5	5	5	5	5	5	5
1%	Yellow	5	5	4/5	5	5	5	5
	Red	5	5	4/5	5	5	5	5
	Blue	5	5	5	5	5	5	5
2%	Yellow	5	5	4	5	5	5	5
	Red	5	5	4	4/5	4/5	4/5	5
	Blue	5	5	4	5	5	5	5

Table 10. Acid perspiration fastness results of samples produced from ring yarns

Depth of shade	**Dye**	**Fading**	**Staining**					
			Acetate	**Cotton**	**Nylon**	**Polyester**	**Acrylic**	**Wool**
0,5%	Yellow	5	5	4/5	5	5	5	5
	Red	5	4/5	4	4/5	4/5	4/5	4/5
	Blue	4/5	5	5	5	5	5	5
1%	Yellow	5	5	4/5	5	5	5	5
	Red	5	4/5	4	4/5	4/5	4/5	4/5
	Blue	5	5	5	5	5	5	5
2%	Yellow	4/5	4/5	3	4/5	5	5	4/5
	Red	4/5	4/5	2/3	4	4/5	4/5	4/5
	Blue	4/5	5	4	4/5	5	5	5

fastness

As the results of acid perspiration fastness tests are examined; for the depths of shade over 1%, the fastness rates are low for both ring and air-vortex based fabrics as seen in Table 9 and 10. It is clearly seen that air-vortex based fabrics demonstrate lower fading and staining versus ring based fabrics at acid perspiration fastness tests.

As seen in Table 11 and 12; for the depths of shade over 1%, alkali perspiration fastness rates are low for both ring and air-vortex fabrics. And it is clear that air-vortex based fabrics' alkali perspiration fastness results are generally better than ring based fabrics' results.

3.4. Evaluation of light fastness

As seen in Table 13, only the red dyestuff displays low fastness values. Ring based fabrics have the similar results with air-vortex based fabrics.

3.5. Evaluation of colorimetric values

Table 14 shows the colorimetric data and CIE WI values of the undyed knitted fabric samples. It is seen that the lightness and whiteness values of the fabric knitted from air-vortex spun yarns are slightly higher than the fabric knitted from ring yarns because of the lower hairiness values of air-vortex spun yarns.

Table 11. Alkali perspiration fastness results of samples produced from air-vortex spun yarns

Depth of shade	Dye	Fading	Staining					
			Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
0,5%	Yellow	5	5	5	5	5	5	5
	Red	5	5	4/5	5	5	5	5
	Blue	5	5	5	5	5	5	5
1%	Yellow	5	5	4/5	5	5	5	5
	Red	5	5	4/5	5	5	5	5
	Blue	5	5	5	5	5	5	5
2%	Yellow	5	5	4	5	5	5	5
	Red	5	4/5	3/4	4/5	4/5	4	4/5
	Blue	5	5	4	5	5	5	5

Table 12. Alkali perspiration fastness results of samples produced from ring yarns

Depth of shade	Dye	Fading	Staining					
			Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
0,5%	Yellow	5	5	5	5	5	5	5
	Red	5	5	4/5	5	5	5	5
	Blue	5	5	5	5	5	5	5
1%	Yellow	5	5	4/5	5	5	5	5
	Red	5	4/5	4	4/5	4/5	4/5	4/5
	Blue	5	5	5	5	5	5	5
2%	Yellow	5	4/5	4	4/5	4/5	4/5	4/5
	Red	4/5	4/5	3	4/5	4/5	4	4/5
	Blue	5	4/5	4	4/5	4/5	4/5	4/5

Table 13. Light fastness results of samples produced from ring and air-vortex spun yarns

Depth of shade	0,5%			1%			2%		
Dye	Yellow	Red	Blue	Yellow	Red	Blue	Yellow	Red	Blue
Air-vortex	4+	2	4+	4+	2/3	4+	4+	2/3	4+
Ring	4+	2/3	4+	4+	2	4+	4+	2/3	4+

Table 14. Colorimetric data and WI_{CIE} values of undyed fabric samples

Undyed Fabric	L*	a*	b*	C*	h	WI_{CIE}
Ring based	94,01	-0,61	1,21	1,36	116,75	82,01
Air-vortex based	94,31	-0,35	0,76	0,84	114,73	82,50

Table 15 and Table 16 show the colorimetric data for the samples knitted from ring and air-vortex spun yarns.

Table 15. Colorimetric data of fabrics produced from ring yarns

Dye	%omf	L*	a*	b*	C*	h	K/S	λ_{max} (nm)
Red	0,5%	53,58	51,14	13,41	52,87	14,69	5,35	520
	1%	47,29	54,45	17,47	57,18	17,79	10,10	
	2%	40,75	55,57	21,59	59,62	21,23	19,21	
Blue	0,5%	50,32	-2,49	-28,11	28,22	264,94	3,61	620
	1%	43,62	-1,65	-29,53	29,57	266,80	5,94	
	2%	34,61	0,13	-30,44	30,44	270,25	11,77	
Yellow	0,5%	76,34	21,41	62,32	65,90	71,04	4,24	440
	1%	74,22	28,07	69,06	74,54	67,88	6,47	
	2%	69,82	34,26	74,57	82,06	65,33	11,48	

Yellow: Yellow FN-2R; Red: Red FN-3G; Blue: Blue FN-R λ_{max} = wavelength of maximum absorption

Table 16. Colorimetric data of fabrics produced from air-vortex spun yarns

Dye	%omf	L*	a*	b*	C*	h	K/S	λ_{max} (nm)
Red	0,5%	53,60	51,39	13,48	53,13	14,70	5,43	520
	1%	46,89	54,92	17,61	57,67	17,78	10,70	
	2%	41,17	55,93	21,40	59,88	20,94	18,91	
Blue	0,5%	50,87	-2,66	-28,14	28,26	264,60	3,51	620
	1%	43,82	-1,71	-29,70	29,75	266,70	5,92	
	2%	34,92	0,05	-30,73	30,73	270,10	11,69	
Yellow	0,5%	76,57	20,82	61,73	65,15	71,36	4,09	440
	1%	72,28	27,93	70,00	75,36	68,25	7,85	
	2%	68,24	34,13	75,93	83,24	65,80	14,17	

Yellow: Yellow FN-2R; Red: Red FN-3G; Blue: Blue FN-R λ_{max} = wavelength of maximum absorption

Table 17. Color differences of fabrics produced from ring and air-vortex spun yarns

Dye	%omf	ΔL*	ΔC*	Δh	ΔE^*_{ab}
Red	0,5%	0,02	0,26	0,01	0,25
	1%	-0,4	0,49	-0,01	0,63
	2%	0,42	0,26	-0,29	0,57
Blue	0,5%	0,55	0,04	-0,34	0,58
	1%	0,2	0,18	-0,1	0,27
	2%	0,31	0,29	-0,15	0,43
Yellow	0,5%	0,23	-0,75	0,32	0,86
	1%	-1,94	0,82	0,37	0,86
	2%	-1,58	1,18	0,47	0,87

Yellow: Yellow FN-2R; Red: Red FN-3G; Blue: Blue FN-R

First of all a decrease in L* values is seen for all dyes. The decrease in L* values which is in relation with the increase in depths of shade is clear for all three dyes. The gradual increase in C* and K/S values for both fabrics is observed as the increase of depth of shade for all three dyes, because the amount of dye molecules bonded to the fabric per unit area is increased. Similar results were obtained when a comparison is made between the K/S values of air-vortex and ring based fabrics. But there is a clear difference between air vortex and ring based fabrics at the 1% and 2% omf depth of shades. The highest L* value of yellow color is caused from the effect of the construction. The hairiness value of air-vortex spun yarn is lower than ring spun yarn, so a compact structure is expected. As a result, the density of the air-vortex based fabric is higher than the ring based fabric. The dyestuff amount per unit area at the air-vortex based fabric is higher than that of ring based fabric. So the K/S value of air-vortex based fabric is higher than that of ring based fabric.

Table 17 shows the color differences of the air vortex and ring spun yarn based fabrics. At this comparison, ring based fabric was accepted as reference.

All values were obtained generally between 0.00-0.60 values for all dyes except yellow at 1% and 2% omf depths of shades. It may be caused from the λ_{max}. The effect of the fabric structure difference is considerably seen at the shortest wavelength.

4. CONCLUSIONS

In this study, the color fastness and colorimetric values of air vortex and ring spun yarns are compared to examine whether the air vortex yarn can be an alternative to the ring spun yarn when only the dyeing properties are considered. The experimental results presented here indicate that most of the color fastness values of air-vortex spun yarn are generally similar or better than that of ring spun yarn. Additionally, air-vortex spinning considerably enhances the wet rubbing fastness properties. One of the important results of this study is that the lightness values of undyed and dyed fabrics are very close to each other for air-vortex and ring spun yarns. Similarly, there is no clear difference between the whiteness values of undyed fabrics of both yarns. These results demonstrate that air-vortex spun yarn has no any obvious weakness when the fastness properties are compared with ring spun yarn. Therefore, air-vortex spun yarn may be the alternative of ring spun yarn if the production cost, fastness and colorimetric properties are taken into consideration.

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Bu araştırma, Bilim Kurulumuz tarafından incelendikten sonra, oylama ile saptanan iki hakemin görüşüne sunulmuştur. Her iki hakem yaptıkları incelemeler sonucunda araştırmanın bilimselliği ve sunumu olarak ***“Hakem Onaylı Araştırma”*** *vasfıyla yayımlanabileceğine karar vermişlerdir.*

YÜKSEK NEM ABSORBE EDEBİLEN ELYAF

Kanebo Spinning Corp of Japan normal polyester lifinden 30 kat fazla nem absorbe edebilen polyester lifi ve ipliği üretmiştir. Bu iplik, iç giyim için uygun olup, yağ ve nem içeren yirmi tabakaya sahiptir. Bu tabakaların toplam kalınlığı 50 **nanometredir**. Ayrıca, Toray Industries tarafından yüksek nem absorbe edebilen ultra ince **naylon** lifi ve ipliği üretilmiştir. (internet).