(REFEREED RESEARCH)

A RESEARCH ON THE PARAMETERS OF THE AFFECTING YARN PROPERTIES OF COTTON-POLYESTER RIGID CORE-SPUN YARNS

PAMUK-POLİESTER SERT ÖZLÜ EĞRİLMİŞ İPLİKLERİN İPLİK ÖZELLİKLERİNİ ETKİLEYEN PARAMETRELER ÜZERİNE BİR ARAŞTIRMA

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ABSTRACT

In this experimental work, the effects of the core-sheath ratio, the filament count of multi-filament yarn, the twist coefficient and the yarn structure of multi-filament yarn (untextured FDY or textured yarn) on yarn properties of ring core-spun yarn were investigated. For this purpose cotton-PET multi-filament ring core-spun yarn (Ne16) produced with four different core-sheath ratios, three different twist coefficients. For determine the effect of filament count of multi-filament yarn on yarn properties, two different filament counts were selected, 36 and 72. The ring core-spun yarns were produced at same condition with 100% PET untextured fully drawn yarns (FDY) and textured yarns. The effect of core-sheath ratio on the yarn tenacity values and the yarn elongation were found statistically significant. The yarn tenacity value of core-spun yarn increased with increasing the sheath ratio in yarn. The effect of twist coefficient on the yarn elongation was found statistically significant for only FDY multi-filament core material type. The yarn elongation (%) values increased with increasing the twist coefficient. As the twist amount increased, it's seen that the yarn evenness and yarn hairiness values have been decreased. It has seen that the yarn evenness value decreased with increasing the core ratio in yarn, for both two core material types.

Key Words: Core-spun yarn, Core ring spinning method, Multi-filament yarn, Core-spun yarn properties, Hard core-spun yarn.

ÖZET

Bu çalışmada, ring özlü iplik eğirme tekniği ile üretilen ipliklerin iplik özelliklerine, öz-manto oranı, multifilament iplikteki filament sayısı, büküm katsayısı ve özde kullanılan multifilament ipliğin yapısının (düz FDY ya da tekstüre) etkileri incelenmiştir. Bu amaçla, Ne 16 inceliğinde pamuk-polyester (PET) multifilament ring eğirme özlü iplikleri dört farklı öz-manto oranı ve üç farklı büküm katsayısı ile üretilmişlerdir. İplik özelliklerine multifilament öz ipliğindeki filament sayısının etkisini belirlemek amacıyla 36 ve 72 filament sayısına sahip iki farklı iplik seçilmiştir. Özlü iplikler ring eğirme yöntemi ile öz kısmında düz tamamen çekilmiş filament iplik (FDY) ve tekstüre filament iplikler kullanılarak pamuk-polyester özlü iplikler aynı koşullarda üretilmiştir. Öz-manto oranının iplik mukavemetine ve kopma uzamasına (%) etkisi istatistiksel olarak önemli bulunmuştur. Manto oranı arttıkça iplik mukavemeti artmıştır. Büküm katsayısının etkisi sadece FDY multifilament öz materyali kullanılarak üretilen iplikler için önemli bulunmuştur. Büküm katsayısı arttıkça iplik kopma uzaması artmıştır. Büküm miktarı arttığında, iplik düzgünsüzlüğü ve iplik tüylülüğü değerleri azaldığı gözlenmiştir. Her iki öz materyali tipi için de öz oranı arttıkça iplik düzgünsüzlüğünün azaldığı görülmüştür.

Anahtar Kelimeler: Özlü iplik eğirme, Özlü ring eğirme yöntemi, Multi filament iplikler, Özlü iplik özellikleri, Sert özlü iplik.

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1. INTRODUCTION

With the developments in textile industry, functional products, which can use for different purposes, gain importance day by day. Therefore, marketshare of core-spun yarns is growing up rapidly. A core-spun yarn composed of two components as core and sheath. Making a core-spun yarn consists of covering an elastic, textured or rigid filament with a cut natural, artificial or synthetic fiber. The properties of elastic core-spun yarn are highly appreciated in the knitwear industry since they give fabrics greater consistency and elasticity. Rigid core-spun yarn, previously designed for technical and sewing yarns, is today used in fabrics to produce more durable and resistant products or to achieve devoré effects in innovative fabrics. The characteristics of this yarn create new possibilities in the core-spun market. (1)

In rigid core-spun yarns, core component permits to advantages like high strength to break, wrinkle resistance, easy care and good dimension stability. In elastic core yarns, core component permits to advantages like wrinkle resistance, easy care and high elasticity. Sheath component is used for conventional appearance, touch and comfort. Core yarns are used in awning fabrics for high tenacity property, special industrial fabrics, medical textiles, underwear clothes, swimsuits, socks, sport clothes and sewing threads. There are different methods for production of core yarns. The most common of them are ring and friction spinning systems.

There have been a lot of studies about rigid core-spun yarns. Sawhney and et al. studied on producing rigid core-spun yam on a modified ring spinning frame and comparison of filament-core spun yarns produced by new and conventional methods. (2, 3). Jeddi, Johari and Merati studied the structural and physical properties of cotton-covered nylon filament core-spun yarns (4). Miao, How and Ho investigated the effect of spinning parameters on core yarn sheath slippage and other properties (5). Sawhney and Ruppenicker investigated the special purpose fabrics made by core-spun yarns and results indicated that the fabrics made with custom-engineered core-wrap bi-component yams offer superior mechanical and functional properties than the traditional 100% cotton equivalents (6). Chattopadhyay and et al. investigated the effect of core-sheath ratio and core type on DREF-III friction-spun core yarns and the results showed that the yarn tenacity, the breaking extension and the resistance to abrasion increase with the increase in the proportion of core fibers up to 70%, irrespective of the core type, but the sheath-slipping resistance, in general, improves with the increase in sheath content. Core contents as well as type of core do not show any relationship with yarn unevenness (7). Salhotra, Ishtiaque and Gowda studied the influence of frictional characteristics of core and sheath, core-sheath ratio, and spinning drums' speed on the tensile characteristics of DREF-3 friction-spun yams (8). Xue, Sun and Sun studied spinning principles and process technology of core-sheath composite yarns in ring spinning (9). Viswarajasekaran and Raghunathan studied on the effect of different process parameters on core-spun yarns made from a modified ring frame. They reported that the properties of core-spun yarns vary with respect to the process parameters like type of fibers in core and sheath, different twist levels and different core-sheath ratio. Reduced sheath content in all types of core yarns increases the tensile strength and yarn regularity but decreases the breaking extension (10). Kim and et al. investigated the effects of the core-sheath weight ratio and twist on the tensile strength of the ring core yarns with high tenacity filaments, fibers and polymers (11). Celik and et al. researched on the effects of core-sheath ratio and twist coefficient on the yarn properties of the ring PET core-spun yarns (12). Yang and et al. modeled theoretically to the core-sheath structuring effects, using a spring and damper as mechanical elements. They reported that increasing the number of twists, the high tenacity PET core-spun yarn had almost unaffected tenacity for various twist levels and this yarn remained in a limited range of elongation with twist (13). Sardar investigated the mechanical characteristics of Kevlar multi-filament-polypropylene (KV M/F-PP) hybrid yarns and its composites in their research (14). Ortlek and et al. investigated the possibility and abilities of core-spun yarn manufacture containing metal wire with the different kinds of ring spinning methods (15). Ziaee and et al. studied the physical and mechanical properties of cotton covered polypropylene-core yarns and fabrics and they produced cotton-covered polypropylene core-spun yarns with using modification of conventional ring spinning frame (16). Shanbeh and et al. researched the effects of different production parameters and number of tensile fatigue cyclic loads on the breaking strength of core-spun yarns before and after tensile fatigue cyclic loads and they used Taguchi's experimental design (17). Das and Chakraborty investigated the interaction effect of elastane stretch, proportion of elastane core and twist multiplier on physical and mechanical properties of stretchable elastane-cotton core-spun yarns and it is observed that these parameters have significant impact on all the yarn characteristics except breaking elongation (18).

There haven’t been any research about specially comparison of filament raw material structure, smooth or textured, and the effect of filament count of multi-filament yarn on the physical properties of ring rigid core-spun yarn. Objective of this work was to investigate the effects of the twist level, the core-sheath ratio, the filament count of multi-filament yarn and filament raw material (untextured or textured) on physical properties of cotton covered-polyester filament rigid core yarns that were produced by ring spinning system.

2. MATERIAL AND METHODS

Polyester smooth fully drawn multi-filament yarn (PET FDY) and polyester textured multi-filament yarn (PET textured) were used as core component and combed cotton sliver (Nm 1,6) was used as sheath component. Cotton fibers used as sheath had an effective length of 33,38 mm and fineness of 3,8 micronaire. PET multi-filament yarns (10 types) were ensured from Company of Korteks (Table 1).

Table 1. The specification of multi-filament yarns.

Yarn Properties	Fineness(dtex)	Filament count	Yarn tenacity (cN/dtex)	Yarn elongation (%)
100% PET untextured FDY	56	36	4,04	32
	83	36	4,1±0,5	34±5
	110	36	4,2	31,6
	167	36	4,1±0,5	34±5
	83	72	4,1±0,5	36±5
100% PET Textured	56	36	≤3,0	22±4
	83	36	≤3,0	22±4
	110	36	≤3,0	20±4
	167	36	≥3,5	28±4
	83	72	≤3,0	22±4

Table 2.Experimental plan of core-spun yarns.

Core material (100% PET FDY and textured)	Yarn count (Ne)	αe= 3,7	αe= 4,1	αe= 4,5
56 dtex- 36 filaments	16	✓	✓	✓
83 dtex- 36 filaments	16	✓	✓	✓
110 dtex- 36 filaments	16	✓	✓	✓
167 dtex- 36 filaments	16	✓	✓	✓
83 dtex- 72 filaments	16	✓	✓	✓

The experimental work of this study was conducted on Pinter-Merlin ring spinning machine by using ten different 100% polyester multi-filament yarns and 100% combed cotton roving. In this study, the effect of multi-filament yarn's structure (untextured or textured), sheath and core ratio, the twist coefficient and the filament count of multi-filament yarns on the yarn physical properties of core-spun yarns were investigated. The details of experimental plan are shown in Table 2. After the spinning trials, the yarn tenacity and elongation, yarn evenness, yarn hairiness and yarn liveliness properties were tested.

Priority for testing the yarn samples were conditioned for 24 hours under standard conditions (65% R.H. and 22 °C). Yarn evenness (CV %), the number of thin places, thick places and neps, yarn diameter and yarn hairiness were measured with Uster Tester 5. Yarn tenacity (cN/Tex) and yarn elongation (%) were measured with Lloyd Strength Tester. The yarn liveliness values were measured by using Keisokki Kringel Factor Meter. The results obtained from the laboratory testing of yarn samples were evaluated by using statistical software. To evaluate the interactions between the parameters, a full factorial design was used and variance analysis was applied, and by using F values we tried to find out if there was any statistically significant difference among the yarn quality data of different core-spun yarns (The details of the test results, statistical results and F values are found in Erez (19)). To deduce whether the parameters were significant or not, p values were examined. Ergun emphasized that if "p" value of a parameter is greater than 0.05 ($p>0.05$), the parameter will not be important and should be ignored (20).

3. RESULTS AND DISCUSSION

The effect of core-sheath ratio on core spun yarn physical properties was evaluated individually for FDY and textured multi-filament yarns (Table 3). The core-sheath ratio varies 15 to 45%. When we examined the yarn properties of the core-spun yarns produced with smooth fully drawn multi-filament yarns, the effect of core-sheath ratio on yarn properties except I.P.I. values (thin places, thick places and nep values) were found statistically significantly.

Student –Newman- Keuls test was used to examine the results in more detail (Table 4). When the core ratio increased in yarn, yarn tenacity, yarn elongation, yarn evenness, yarn hairiness and yarn diameter values decreased and yarn liveliness values increased. When we examined the yarn tenacity, yarn elongation and yarn evenness values, there were not found statistically significant difference for 15%, 22% and 30% core ratios, but between these values and 45% core ratio the differences were found statistically significant (Table 4).

When we examined the yarn properties of the core-spun yarns produced with textured multi-filament yarns, the effect of core-sheath ratio on yarn tenacity, yarn elongation, yarn evenness and yarn liveliness values were found statistically significantly. Student- Newman- Keuls test was used to examine the results in more detail (Table 5). When the core ratio increased, the yarn tenacity and the yarn evenness values decreased, on the other hand the yarn liveliness and the yarn elongation values increased. According to the yarn tenacity, there were found statistically significant difference between 15-22.5% and 30-45% core ratios (Table 5). For textured core material, as the core ratio increased, the yarn elongation and the yarn liveliness increased. Textured yarns have very good elongation, so that the elongation of core spun yarn increases with increasing the textured core ratio.

Table 3. The evaluation of core-sheath ratio of core spun yarns.

Core material	Yarn properties	F value	p value (significance)
Smooth fully drawn multi-filament yarns (FDY)	Yarn tenacity (cN/tex)	40,612	0,000*
	Yarn elongation (%)	5,262	0,003*
	Yarn unevenness (Uster Cv%)	5,277	0,003*
	Thin places/1000m	0,672	0,573
	Thick places/1000m	0,477	0,700
	Nep values/1000m	1,120	0,350
	Yarn hairiness (Uster H)	5,611	0,002*
	Yarn diameter	66,709	0,000*
	Yarn liveliness (Kr factor)	63,753	0,000*
Textured multi-filament yarns	Yarn tenacity (cN/tex)	12,602	0,000*
	Yarn elongation (%)	5,522	0,002*
	Yarn evenness (Uster Cv%)	16,777	0,000*
	Thin places/1000m	1,000	0,401
	Thick places/1000m	0,981	0,410
	Nep values/1000m	0,854	0,471
	Yarn hairiness (Uster H)	1,083	0,365
	Yarn diameter	1,949	0,134
	Yarn liveliness (Kr factor)	1129,300	0,000*

* Statistically significant for αm= 0.05

Table 4. The evaluation of core-sheath ratio of core spun yarns (Student Newman Keuls Test) (core material: PET FDY)

Yarn specifications	Subgroups	The effect of core-sheath ratio on core spun yarns. (core material: PET FDY)			
		15/85%	22,5/77,5%	30/70%	45/55%
Yarn tenacity (cN/tex)	1				7,2528
	2	8,4523	8,4190	8,3230	
Yarn elongation (%)	1			18,7787	9,8007
	2	27,6060	22,8153	18,7787	
Yarn evenness (Uster Cv%)	1				7,5233
	2	8,1773	7,9593	7,9133	
Yarn hairiness (Uster H)	1			5,1633	5,0573
	2		5,3480	5,1633	
	3	5,4113	5,3480		
Yarn diameter	1				0,2691
	2		0,2783	0,2769	
	3	0,2797	0,2783		
Yarn liveliness (Kr factor)	1	6,0767			
	2		6,7983	6,7633	
	3				7,0800

Table 5. The evaluation of core-sheath ratio of core spun yarns (Student Newman Keuls Test) (core material: PET textured multi-filament yarn)

Yarn specifications	Subgroups	The effect of core-sheath ratio on core spun yarns. (core material: PET textured multi-filament yarn)			
		15/85%	22,5/77,5%	30/70%	45/55%
Yarn tenacity (cN/tex)	1			7,0729	6,9859
	2	7,7503	7,5995		
Yarn elongation (%)	1	14,3613	19,0867	20,8227	
	2				59,6953
Yarn evenness (Uster Cv%)	1				7,2613
	2	8,1327	7,8973	8,0653	
Yarn liveliness (Kr factor)	1	6,6183			
	2		6,9250		
	3			7,3167	
	4				7,5343

The effect of multi-filament yarn's structure on the yarn tenacity, the yarn elongation, the yarn diameter and the yarn liveliness values were found statistically significant. Texturing process causes decrease in yarn strength. The yarn tenacity of feed yarn is always more than the yarn tenacity of textured yarn, so the yarn tenacity values of yarns produced with smooth fully drawn multi-filament yarns were found higher than the yarn tenacity values of yarns produced with textured multi-filament yarns. The yarn elongation values of the textured core-spun yarns produced with 55/45% sheath-core ratio were found the highest value, but generally the yarn elongation values of FDY core-spun yarns were found higher than the yarn elongation values of textured core-spun yarns (Figure 1). This situation is unexpected. In fact, textured yarns have higher yarn elongation (%) than smooth yarns. It was thought that the core-spun yarn structure caused this situation. The sheath part of core-spun yarn makes a constraint on the elongation of yarn and so that the core part of yarn cannot show the its actual elongation in the yarn structure. The yarn diameter and the yarn liveliness values of core-spun yarns produced with textured yarns were found higher than the yarn diameter values of core-spun yarns produced with smooth fully drawn multi-filament yarns (Figure 2, Figure 3).

In terms of determining the effect of filament count of multi-filament yarn on the yarn properties, two different filament counts, 36 and 72, were selected for both of core material types (83 dtex textured yarn and 83 dtex FDY). The paired sample t test was applied. The results of t test were given in Table 7. As seen from the Table 7, for FDY core material, the effect of the filament count of multi-filament yarns on the yarn tenacity, the yarn elongation, the yarn hairiness, the yarn diameter and the yarn liveliness values were found statistically significant. When the filament count increased in multi-filament yarn, the yarn tenacity, the yarn elongation, the yarn hairiness and the yarn diameter values decreased and on the other hand the yarn liveliness values increased.

Table 6. The effect of multi-filament yarn's structure (FDY or textured) on yarn properties

Yarn properties	F value	p value (significance)
Yarn tenacity (cN/tex)	116,930	0,000*
Yarn elongation (%)	5,222	0,025*
Yarn evenness (Uster Cv%)	1,256	0,265
Thin places/1000m	0,676	0,413
Thick places/1000m	0,946	0,333
Nep values/1000m	0,019	0,889
Yarn hairiness (Uster H)	1,924	0,169
Yarn diameter	110,885	0,000*
Yarn liveliness (Kr factor)	990,802	0,000*

* Statistically significant for αm= 0.05

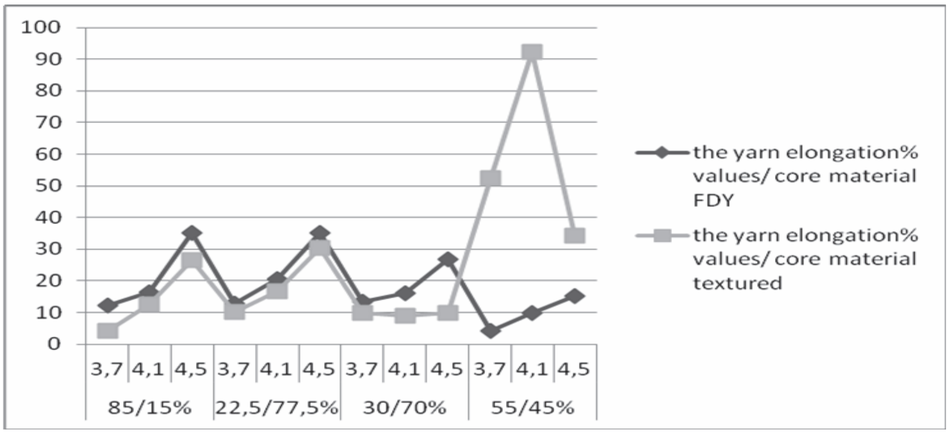

Figure 1. The yarn elongation (%) values of core spun yarns (α_e =3,7, α_e= 4,1, α_e = 4,5).

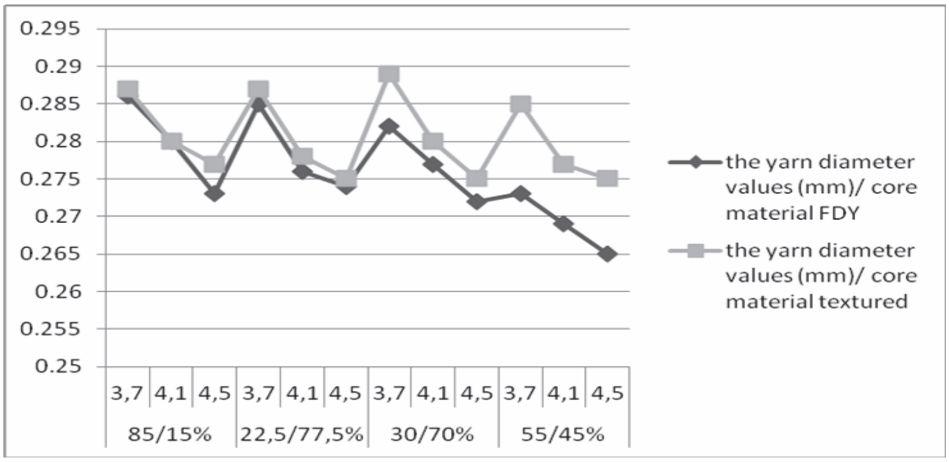

Figure 2. The yarn diameter (mm) values of core spun yarns (α_e =3,7, α_e= 4,1, α_e = 4,5).

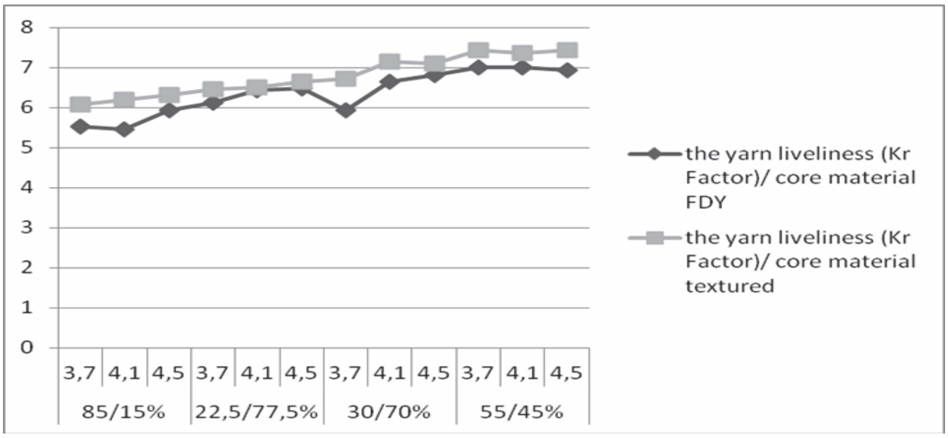

Figure 3. The yarn liveliness values (Kr factor) of core spun yarns (α_e =3,7, α_e= 4,1, α_e = 4,5).

When we examined the t test results of textured core yarns, the effect of the filament count of multi-filament yarns on the yarn tenacity, the yarn elongation, the yarn evenness, the nep and the yarn diameter values were found statistically significant. When the filament count increased in multi-filament yarn, the yarn tenacity and the yarn elongation values increased and on the other hand the yarn evenness, nep and the yarn diameter values decreased.

When we examined the yarn properties of the core-spun yarns produced with smooth fully drawn multi-filament yarns, the effect of twist coefficient on yarn tenacity, yarn elongation, yarn hairiness, yarn diameter and yarn liveliness values were found statistically significantly (Table 8). In general, when the twist coefficient increased, the yarn tenacity, the yarn elongation and the yarn liveliness values increased and on the other hand the yarn hairiness and the yarn diameter values decreased. For textured core material, the effect of twist coefficient on yarn tenacity, yarn hairiness, yarn diameter and yarn liveliness values were found statistically significantly and the yarn tenacity and the yarn liveliness values increased with increasing the twist coefficient, on the other hand the yarn hairiness and the yarn diameter values decreased with increasing the twist coefficient.

Table 7. The effect of filament count of multi-filament yarn (83 dtex PET multi-filament yarn) on yarn properties

Filament count of multi-filament yarn	Yarn properties	t	p value (significance)
36 - 72 (Untextured FDY)	Yarn tenacity (cN/tex)	-6,126	0,000*
	Yarn elongation (%)	-4,757	0,000*
	Yarn hairiness (Uster H)	-2,467	0,027*
	Yarn diameter	-11,188	0,000*
	Yarn liveliness (Kr factor)	5,843	0,000*
36 - 72 (Textured yarns)	Yarn tenacity (cN/tex)	9,3	0,000*
	Yarn elongation (%)	2,704	0,017*
	Yarn evenness (Uster Cv%)	-12,148	0,000*
	Nep values/1000m	-2,306	0,037*
	Yarn diameter	-4,116	0,000*
	Yarn liveliness (Kr factor)	13,096	0,000*

* Statistically significant for αm= 0.05

Table 8. The effect of twist coefficient on yarn properties

Factor	Yarn properties	F value	p value (significance)
Untextured FDY	Yarn tenacity (cN/tex)	17,294	0,000*
	Yarn elongation (%)	6,511	0,003*
	Yarn hairiness (Uster H)	37,414	0,000*
	Yarn diameter	109,230	0,000*
	Yarn liveliness (Kr factor)	8,453	0,000*
Textured multi-filament yarn	Yarn tenacity (cN/tex)	9,366	0,000*
	Yarn hairiness (Uster H)	41,770	0,000*
	Yarn diameter	114,109	0,000*
	Yarn liveliness (Kr factor)	216,560	0,000*

* Statistically significant for αm= 0.05

4. CONCLUSION

The ring core-spun yarn consists of two main parts: sheath and core. The mechanical performance of the yarn is mainly determined by the core filaments. Therefore, the effect of the core part of core-spun yarn on yarn properties was aimed to investigate. In this experimental work, the effects of the core-sheath ratio, the filament count of multi-filament yarn, the twist coefficient and the yarn structure of multi-filament yarn (FDY or textured) on yarn properties of ring core-spun yarn were investigated. For this purpose cotton-PET multi-filament ring core-spun yarn produced with four different core-sheath ratios, three different twist coefficients. For determine the effect of filament count of multi-filament yarn on yarn properties, two different filament count were selected, 36 and 72. The ring core-spun yarns were produced at same condition with 100% PET smooth fully drawn yarns (FDY) and textured yarns.

A lot of researchers reported that rigid filament core-spun yarns have higher yarn tenacity values than the conventional ring spun yarns (4, 5, 6, 7, 10). The rigid filament core-spun yarns are used in places which require high strength so that the yarn tenacity value is an important parameter for these yarns. When examined the yarn tenacity values according to the use of textured or FDY, the yarn tenacity values of the core-spun yarn produced with FDY were found higher than the yarn tenacity values of the core-spun yarn produced with textured yarn. The effect of core-sheath ratio on the yarn tenacity values were found statistically significant. When the sheath ratio increased in yarn, the yarn tenacity value of core-spun yarn increased too. Ortlek and et al. (15) found similar results with our results, meanwhile the opposite results were observed in some studies (10, 12). Analyzing of the effect of filament count on yarn tenacity value, at the core spun yarn produced with FDY, the yarn tenacity increased with increasing the filament count in multi-filament yarn. On the other hand, at the core spun yarn produced with textured filament yarn, the yarn tenacity decreased with increasing the filament count in multi-filament yarn.

The effect of core-sheath ratio on the yarn elongation (%) was found statistically significant. For FDY, when the core ratio increased, the yarn elongation decreased. The elongation (%) values of core-spun yarns produced with FDY have higher values than the yarn elongation values of core-spun yarns produced with textured yarns except 45/55% core-sheath ratio. For textured multi-filament yarn, the core-spun yarns produced with 45/55% core-sheath ratio have the highest elongation (%) values. The effect of filament count of multi-filament yarn on the yarn elongation (%) was found statistically significant, but the tendency of elongation (%) values was found opposite for two type core materials. The yarn elongation (%) of the core-spun yarn produced with 72 filament counts was found higher than the yarn elongation (%) of the core-spun yarn with 36 filament counts for FDY. On the other hand, for textured yarn, the core-spun yarn produced with 36 filament counts has higher yarn elongation (%) than the core-spun yarn with 72 filament counts. The effect of twist coefficient on the yarn elongation was found statistically significant for only FDY core material type. The yarn elongation (%) values increased with increasing the twist coefficient.

When examined the yarn evenness values, the effect of core-sheath ratio on the yarn evenness values was found statistically significant. It has seen that when the core ratio increased in yarn, the yarn evenness value decreased for both two core material types and same result was observed in some studies (10, 12). Analyzing of the effect of filament count on yarn evenness value, at the core spun yarn produced with textured filament yarn, when the filament count increased in multi-filament yarn, the yarn evenness increased. It is related with the bulkiness of yarns. The textured yarn becomes more bulky with increasing the filament count in multi-filament yarn. The yarn diameter of the core-spun yarn with 72 filament counts is more than the yarn diameter of the core-spun yarn with 36 filament counts at the same linear density. The difference of between two yarns in terms of yarn diameter was found statistically significant. It has been thought that the yarn evenness value of core-spun yarn increase with increasing bulkiness of textured yarn. The effects of the core material structure and the twist coefficient on the yarn evenness value were not found statistically significant. On the other hand, some researchers reported that the yarn evenness decreased with increasing of twist value (10, 12).

In terms of yarn liveliness values of core spun yarns, core-sheath ratio is very important and it has been demonstrated that there are statistically significant differences for the significance level of α=0.05 between different core-sheath ratios. It has seen that when the textured multi-filament yarn was used to as a core part, the yarn liveliness values were higher than smooth multi-filament yarn. The false twist textured yarns have higher yarn liveliness and it has been thought that this situation was related with high yarn liveliness of false twist textured yarns. In addition, the effect of filament count of multi-filament yarn on the yarn liveliness values of core-spun yarns was found statistically significant. The yarn liveliness values increased with increasing the filament count at the same yarn linear density. It has been thought that it is related with bending rigidity of filament yarn. The yarn liveliness value is mostly related with twist coefficient. The yarn liveliness increased with increasing the twist coefficient.

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