ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES, LEATHERWORK

ASPECTS OF THE INFLUENCE OF TECHNOLOGICAL PARAMETERS ON THE TENSION PROPERTIES OF THE YARNS

HRISTIAN Liliana[1], BORDEIANU Demetra Lacramioara[1] and OSTAFE Maria Magdalena[1]

[1]*"Gheorghe Asachi" Technical University of Iasi, Faculty of Textile, Leather & Industrial Management, Department of Engineering and Design of Textile Products, Blvd. Mangeron, No.28, Iasi, Romania*

Corresponding author: Hristian Liliana, e-mail: hristian@tex.tuiasi.ro

Abstract: *This paper presents the results of some experiments performed using the power system bands directly from the card to the rotor spinning machine and the spinning system used by passing the lanes on two passages mill and fed to the spinning rotor. In this study we analized the influence of technological parameters of the preparation drawing on the assessing indicators for the tensile strength of the Nm20, Nm24, Nm27 Nm34 and Nm40 yarns. The fineness range studied was made of three fiber mixtures of different varieties of cotton, coded as follows: A1-85% Soviet cotton+15% Chinese cotton medium II; A2-100% Turkish cotton medium III; A3-100% American cotton mdium IV.*
The method of preparation of the bands which are to be powered to the rotor spinning machine, respectively with the aggregate pile-card and the powered bands directly to the rotor spinning machine and the adding of two rolling mill, detemines different structures of bands and different degrees of untangling and orientation of the fibers, which influences the quality of the obtained yarns. This study reveals a considerable improvement of the tensile properties when the yarns are made from rolled band, which is explained by the high degree of correction and parallelization of the fibers of the rolled band, which allows a greater participation of fibers with their resistance to the resistance of the yarns.

Key words: *fiber fineness, coefficient of variation, the rotor spinning machine, yarns strength, technological parameters*

1. INTRODUCTION

The parameters of the raw material significantly influence the basic quality parameters of the yarns. Numerous studies have shown that the quality of ring-spun yarns is influenced primarily by length, strength and fineness of fibres, and that of rotor-spun yarns by strength, fineness of fibres, length of fibres and regularity of fibre length, as well as impurity content [1-3].

In comparison with classic yarns produced from raw materials of the same characteristic, rotor-spun yarns have a different geometrical construction with a smaller degree of fibre arrangement along the yarn axis [4-6]. Hence we also have lower strength of the yarn and lower irregularity of linear density and strength [7].

Today, rotor spinning has a production rate exceeding 200 m/min, as compared to a maximum of about 40 m/min in ring spinning [8-10]. Rotor spinning eliminates the need for roving, since rotor yarns can be spun directly from drawn sliver. Unlike a ring frame, the winding and

twisting functions are separate and this permits the building of large yarn packages [11-13]. Both these characteristics allow much higher levels of productivity than ring spinning [12-14].

Rotor spinning was initially developed with two main objectives: to provide a more economical spinning system than conventional ring spinning through higher productivity, and to produce yarn of a quality that matches or surpasses that of the conventional ring spinning [14].

The properties most affected are the elongation at break and yarn imperfections, particularly thick places, so that the yarn irregularity is also affected. Increases in winding tension above a given value reduce the yarn quality quite independently of the package mass [13-15]. When the winding tension is low, however, this mass exerts some influence, the yarn quality deteriorating as the package mass increases

2. EXPERIMENTAL PART

2.1. Materials and methods

The main features of the cotton fibers from the sorts analyzed in the study are shown in Table 1.

Table 1: *The cotton fibers characteristics*

Type and sort of cotton	The length (mm)	Short fiber (%)	Breaking length (km)	Strength (cN /fb)	Impurities (%)	Fineness (Nm)
Turkish medium III	28,5	23,7	25,5	4,42	4,32	5770
American medium IV	30,0	27,8	24,03	4,23	6,92	5682
Chinese medium II	30,1	17,65	20,08	3,81	2,06	5272
Sovietic medium II	28,8	20,0	27,76	4,04	3,08	5736

To minimize the number of the impact parameters on the quality of the studied fibers it was adopted the same spinning plan for all fiber blends. The technological parameters used in the experiment are shown in Table 2.

Table 2: *The used spinning Plan*

Machine name		Nm_d	L	D	α_p	T (răs/m)	The speed of characteristic organ/element
4C card		0,25	100	-	-		14 rot/min
Rolling mill LB	LB I	0,25	6	6	-		150 m/min
	LB II	0,25	6	6	-		150 m/min
Spinning machine BD 200		20	80	1	80	590	31.000 rot/min
		24	96	1	80	666	31.000 rot/min
		27	108	1	82	738	31.000 rot/min
		34	136	1	80	840	31.000 rot/min
		40	160	1	80	937	31.000 rot/min

The properties of blended rotor spun yarn depend upon various factors such as fibre characteristics, machine variables and processing variables. Twist factor is one of the main processing variables in the rotor spinning system.

2.2. Results and discussions

Strength parameters of yarns are especially important for rotor-spun yarns. Due to their different method of forming, these parameters are lower than for ring-spun yarns. Because of their higher elasticity, rotor-spun yarns are used mainly for knitting purposes. This feature makes up for the lower tenacity of these yarns. Table 3 presents the main features of the card and mill blanks obtained for the two versions of spinning system, in the study performed by us.

Table 3: *Characteristics of blanks*

The name of textile commodity	The mixture	The fineness		Irregularity U(%)
		$\overline{Nm}$	CV%	
Card blanks	A_1	0,245	2,01	4,0
	A_2	0,252	1,80	4,6
	A_3	0,255	1,67	5,3
The I st mill blanks	A_1	0,242	1,90	3,5
	A_2	0,250	2,10	4,2
	A_3	0,253	1,50	4,2
The II nd mill blanks	A_1	0,250	1,75	3,6
	A_2	0,252	1,57	4,2
	A_3	0,247	1,48	4,5

The average values of the coefficient of variation of resistance to tearing for the range yarns fineness, from the three mixtures, obtained using the supply system of bands directly from the card to the BD rotor spinning machine, are shown in graphical representation of Fig.1.

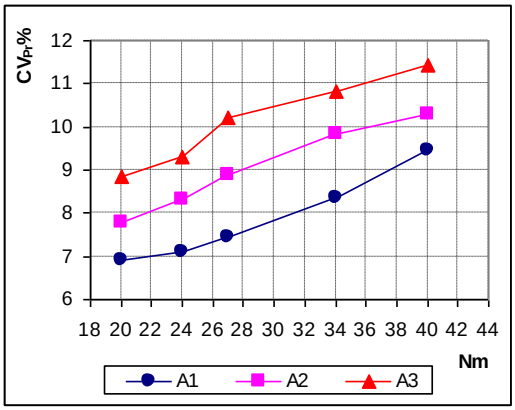

Fig. 1: *The coefficient of variation of tensile strength depending on the smoothness of yarns obtained on the spinning system directly from the ban, from the card to the BD rotor spinning machine*

The average values of the coefficient of variation of resistance to tearing for the range yarns fineness of the three mixtures obtained by passing the bands from card to the two passages mill and then supplied at the BD rotor spinning machine, are shown in Fig.2 .

It finds that withthe yarns increasing fineness, it increases, also, the coefficient of variation of the ultimate strength, irrespective of the adopted spinning system. For the same finesse yarns it was recorded a substantial variation decrease of the coefficient of resistance to tearing, in spinning yarns from rolled bands.

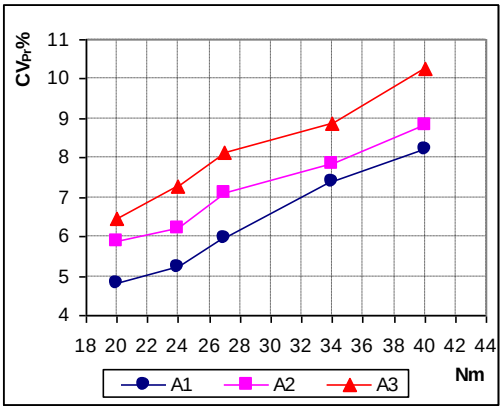

Fig. 2: *The coefficient of variation of tensile strength depending on the fineness of yarns obtained on rolled bands spinning system and supplied to the BD rotor spinning machine*

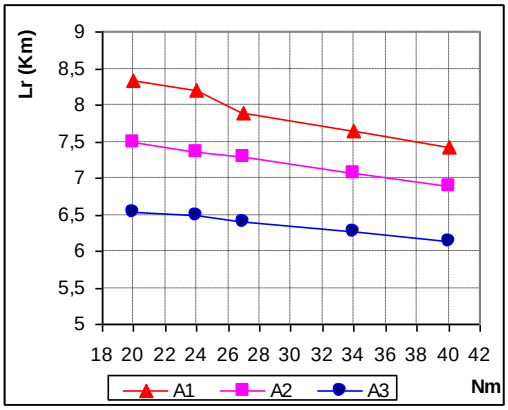

Fig. 3: *The variations of length breaking ,depending on the fineness of the yarns obtained from the spinning system directly from band card to the BD rotor spinning machine*

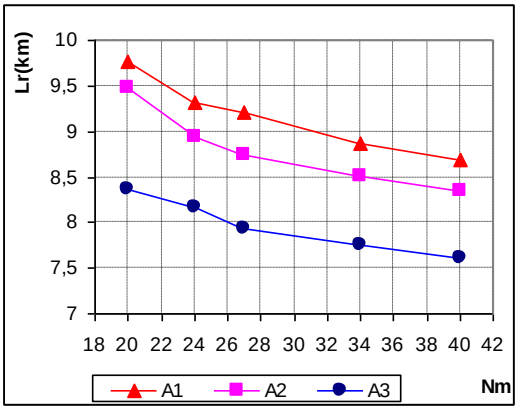

Fig. 4: *Length variation depending on the smoothness of breaking wires obtained filariae system rolled strip and fed the BD rotor spinning machine*

It finds that the breaking length decreases as the threads increases smoothness (Fig. 3), finesse same thread but is higher when using two passages mill to obtain strip that feeds the rotor spinning machine (Fig..4).
So the utilisation of fibre strength is greater than that of the rotor spinning system. Rotor spun yarns are generally produced using high twist factor in order to ensure adequate tenacity in subsequent processing and mechanical performance in use.

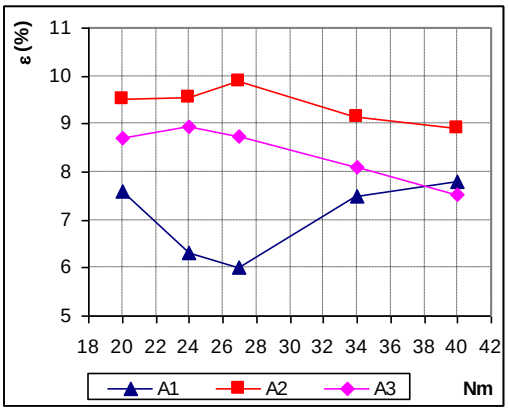

Fig. 5: *The variations of the elongation according to finenesse of the yarns obtained from the spinning system supplied directly from card bands to the BD rotor spinning machine*

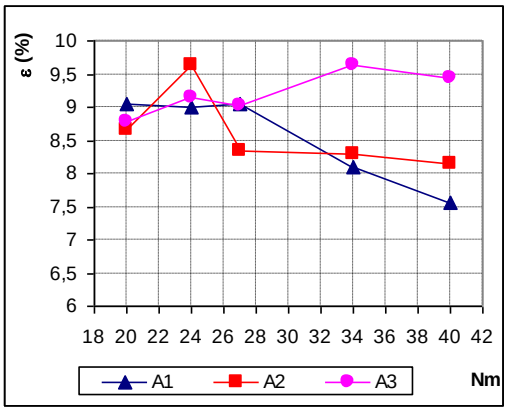

Fig. 6: *The variations of the elongation according to finenesse of the yarns obtained from the spinning system supplied directly from mill bands to the BD rotor spinning machine*

Elongation at break is significantly influenced by the fineness of the threads and no technological solution adopted in preparation spinning differences înegistrate not exceed one unit (Fig.5, Fig. 6).

3. CONCLUSIONS

From the data obtained, we can conclude the following :
The fineness irregularity increases with the increasing of the fineness. It is noticeably higher when spinning is directly from the band card, due to not only the supplied band irregularity, higher in case of card bands (U = 4.6%) than for mill bands (U = 4.2%) but also the density decreases and the influence of the degree of parallelization of the fibers.

Regarding the quality of the cotton, it is observed that the fineness irregularity is less for cotton yarns spun from Medium II cotton (U = 4%) than the yarns obtained from Medium III cotton (U = 4.6%) or Medium IV cotton (U = 5.3%).

Strength improves considerably when the yarns are made from rolled/mill bands, because of the increased degree of correction and parallelization of the fibers from rolled bands, which allows a greater participation of fibers with their resistance to the yarns resistance.

The irregularity of the resistance increases with the increasing fineness of the yarns. For the yarns with the same finesse it was registered a substantial decrease of the variation coefficient for breaking load, if spinning yarns are from rolled band.

REFERENCES

[1] T. Jackowski, B. Chylewska, D. Cyniak, "*Cotton Yarns from Rotor Spinning Machines of 2nd and 3rd Generation"* Fibres & Textiles, Vol. 8, No. 3, pp.12-15, 2000.

[2] D.L. Bordeianu, *"Tehnologii si utilaje in filaturi"* vol. 1, Ed. Ancarom, Iasi, 1997

[3] L. Hristian, A.V. Sandu, L.R. Manea, E.A. Tulbure, K. Earar "*Analysis of the Principal Components on the Durability and Comfort Indices of the Fabrics Made of Core-coating Filament Yarns"* Revista de Chimie, Nr. 3, 66, pg. 342-347, 2015.

[4] L. Hristian, D.L. Bordeianu, G. Böhm-Révész, *"Comparative aspects concerning methods used to determine cotton fibers strength per denier*"Annals of the University of Oradea. Fascicle of Textiles, Leathe, Vol. 16, Nr. 2, pg. 35-40, 2015

[5] B. Chylewska, D. Cyniak, "*Requirements for Fibres Used for Rotor-Spun Yarns*" Bulletin of the Gdynia Cotton Association, No 4, pp. 33-47 (in Polish), 1998.

[6] D. L. Bordeianu *„Fizico-chimia si proprietatile fibrelor*", Ed. Performantuca, Iasi, 2012

[7] L. Hristian, D.L. Bordeianu, P. Iurea, I. Sandu, K. Earar, *„Study of the Tensile Properties of Materials Destined to Manufacture Protective Clothing for Firemen"*Revista de Materiale Plastice, Vol. 51, no. 4, pp. 405-409, 2014.

[8] G. Trommer, *"Rotor Spinning"*. Deutscher Fachverlag, Frankfurt, 1995.

[9] M. Chirita, V. Gribincea and L. Manea "*Indicators of appreciating the traction deformation of the core yarns"* Industria Textila , 48, no. 2, pp. 82-84, 1997.

[10] P.R. Lord, Hand Book of Yarn Production: Science, *Technology and Economics*, Tailor and Francis, 2003.

[11] D.L. Bordeianu, L. Hristian, *„Aspects concerning the cleaning of simple and twist cotton-type yarns"*, Buletinul Institutului Politehnic Iaşi, Tomul LIX (LXIII), Fasc 1-2, Secţiunea Textile Pielărie, pp. 9-16, 2013.

[12] H.J. Hyrenbach *"The benefits of rotor yarn structure in terms of processing characteristics and application.*" Melliand Textilberichte, No.4, pp. 42, 2002.

[13] D.L. Bordeianu, „*Tehnologii generale textile*" Ed. Universitatii din Oradea, ISBN 973-613-055-X, 2002.

[14] E. Meyer*„Analyse der Garnbildung zur Beeinflussung der Garnstruktur beim Open-EndRotorspinnverfahren"*, Diss. RWTH Aachen, 2000.

[15] Neculăiasa, M., Hristian, L., „*Metrologie Textilă"* Vol. I, pg. 326, Ed. Performantica, Iaşi, 2004, ISBN 973-7994-36-1