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STUDYING THE INFLUENC OF ROTOR SPEED AND DIAMETER ON THE PROPRTIES OF COMBED ROTOR SPUN YARN

دراسة تأثير قطر وسرعة الرتور على خواص خيوط الطرف المفتوح الممشطة

By
Dr. Fawkia F. EL-Habiby
Textile Dept., Faculty of Eng.
Mansoura University

خلاصة:

يهدف هذا البحث الى دراسة تأثير بعض متغيرات التشغيل فى ماكينات غزل الطرف المفتوح على خواص الخيوط المنتجة. حيث تم دراسة تأثير سرعة وقطر الرتور على خواص خيوط غزل الطرف المفتوح الممشطة والمسرحة . حيث تم انتاج ثلاثة نمر متوسطة من شرائط مسرحة وممشطة وذلك باستخدام ثلاث مستويات لسرعة الرتور ومستويين لقطر الرتور . وقد أوضحت النتائج أن الخيوط المسرحة اكثر انتظامية من الخيوط الممشطة ، وذلك على عكس خيوط الغزل الحلقى ، كما وجد أن زيادة سرة الرتور لها تأثير سلبى على خواص الخيوط المنتجة ، على سبيل المثال لاالحصر ، بالنسبة لخيط ٢٦ انجليزى ، بزيادة سرعة الرتور من المستوى الأول الى المستوى الثالث انخفضت متانة الخيط المسرح بمقدار ٢٤ ، ١٥% لقطر الرتور الصغير والكبير على الترتيب . بينما فى حالة الخيوط الممشطة كان الانخفاض عند نفس الظروف ٢١ ، ١١% . وجد أيضا ان انتظامية الخيوط تتحسن بزيادة قطر الرتور .

ABSTRACT

In this work the influence of sliver preparation has been investigated with rotor speed and diameter. Three yarn counts (medium range) were produced, using carded and combed sliver. Each yarn was produced at three levels of rotor speed and two levels of rotor diameter. Properties of the produced yarns were examined . Results show that, increasing rotor speed deteriorates yarn regularity, strength, elongation and imperfections of combed yarns. Increasing rotor diameter reduced number of thin places. It also improved regularity of combed yans

1- INTRODUCTION

A lot of literatures has been published concerning the technology of open end spinning and the properties of the yarns produced from carded sliver under different processing variables

In a previous work (1), experiments were carried out to investigate the effect of yarn count, sliver preparation and combing ratio on the quality of rotor yarns, as a result of combing, rotor yarn tenacity increases by about 12%

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Hellwing and Soliman (2) studied the influence of rotor diameter, pinning of opening roll, rotor wall hight and rotor groove radius (at constant rotor speed) on carded and combed rotor yarn properties.They found that, the use of high wall rotor can improve results in fine count range. The use of combed cotton sliver leads to better yarn strength and higher spinning limits.

Landwehrkamp (3) studied the properties cosequence on subsequent processing and the quality of end products of rotor yarns and stated that: combed rotor yarns offer better quality, increased productivity, higher efficiency in subsequent processing and higher quality end product. They stated that: for combed rotor yarns there is no general value of combing ratio can be applied for all situations. In one case 10% combing ratio was optimum and in other cases 12, 14, and 16% were best.

In the present work, a study was made of the effect of yarn count, rotor speed and rotor diameter on the properties of combed and carded open-end rotor yarns. The choosen combing ratio was 15%. The plan of experiments "complete factorial design" was constructed using four variables at different levels.

2-EXPERIMENTAL PLAN AND TESTING

2-1-Experimental investigation

In the plan of work the following variants were adopted during experiments:

yarn count (Ne): 14 , 20 and 26, with twist multiplier (αe) = 3.8

sliver preparation: carded and combed (15% noil)

rotor speed: 40,000 - 46,000 - 52,000 r.p.m

rotor diameter: 40 and 46 mm

2-2- Yarn production

Egyption cotton (G 70) of 29 mm mean fibre length, 4.5 micronair reading and Pressely index 10.1 lb/mg was processed to carded and combed slivers (Ne 0.13). Procssing involved carding (Rieter), followed by two drawframe passages (Zinser) for producing carded sliver. For combed sliver, drawing at supper lap machine and comber (Howa) were involved after carding. Spinning was carried out on rotor spinning machine (BD200), opening roll speed was 7730 r.p.m. The other parameters were kept constant.

2-3- Test method

For each of 36 experimental combination the following yarn parameters were anlysed:

irregularity: C.V% (Uster Evenness Tester III),

imperfections: thin, thick and neps/1000 m of yarn (Uster Imperfection Indicator)

tenacity: g/tex (Uster Tensomat) and

breaking elongation (%)

2-4- statistical analysis of results

According to the plan of work four parameters were included at different levels using complete factorial design. Analysis of variances between these parameters and their interaction were carried out. The data were grouped as shown in Table (I) and summary of analysis is shown in table (II).

Table (I) Grouping of data for stastistical analysis

	b1						b2					
	c1		c2		c3		c1		c2		c3	
	d1	d2	d1	d2	d1	d2	d1	d2	d1	d2	d1	d2
a1	-	-	-	-	-	-	-	-	-	-	-	-
a2	-	-	-	-	-	-	-	-	-	-	-	-
a3	-	-	-	-	-	-	-	-	-	-	-	-

(- : measured values)

yarn count (Ne): a1 = 14, a2 = 20, a3 = 26

sliver prparation: b1 = carded, b2 = combed

rotor r.pm: c1 = 40000, c2 = 46000, c3 = 52000

rotor diameter (mm): d1 = 40, d2 = 46

3- DISCUSSION

3-1- Yarn irregularity

Yarn irregularity is significantly influenced by yarn count, sliver preparation, rotor speed and rotor diameter as shown in table (II). Also yarn irregularity was significantln affected at 95% by the combind effect of sliver preparation and the other three factors (yarn count, rotor speed and diameter).

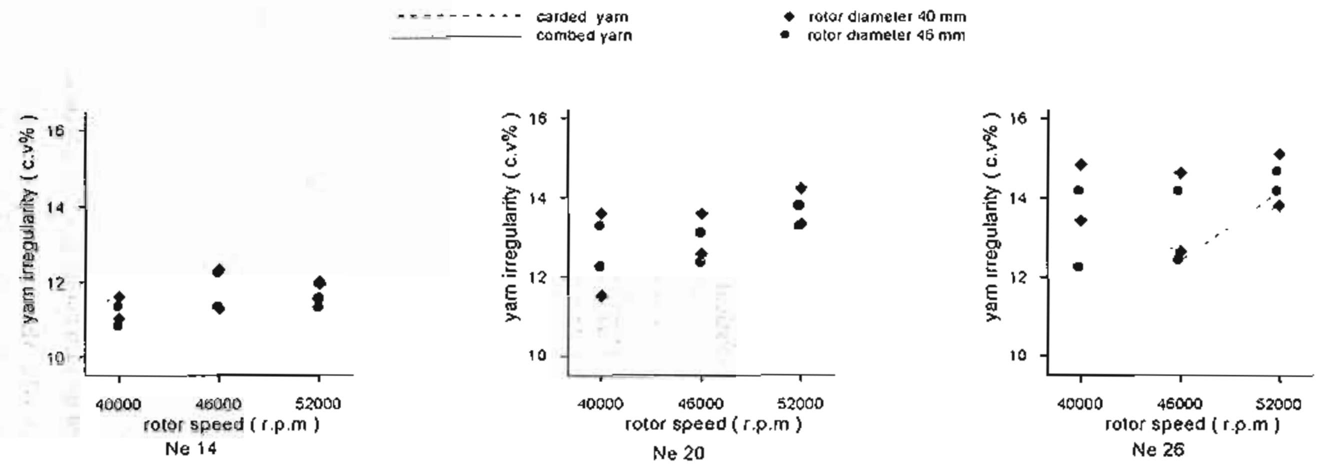

FIG (1-a) EFFECT OF SLIVER PREPARATION,ROTOR SPEED AND ROTOR DIAMETER 0N YARN IRREGULARITY

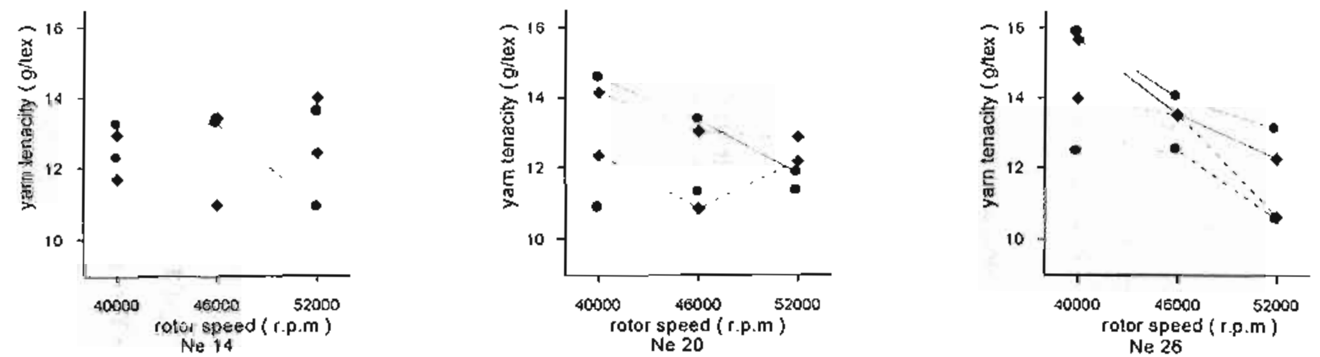

FIG (1-b) EFFECT OF SLIVER PREPARATION ROTOR, SPEED AND ROTOR DIAMETER ON YARN TENACITY

FIG. (1)

As shown in fig. (1-a), comparing the results of sliver preperation, carded yarns has lower c.v% i.e, more regular than that for combed yarns. This means that combing process has a negative effect on yarn regularity in contrast to earlier work (2) since it has been stated that, no influence of the combing process on yarn evennes

Table (II) Summary of analysis of variance between parameters and their 1st interaction

(M S V)

Parameter	Yarn Properties					
	Tenacity g/tex	Elongatuio %	Irregularity c.v %	Imperfections/1000m thin	thick	neps
a	1.2845	1.625*	11.98*	19.25*	1670.4*	414.1*
b	26.905*	0.09	6.678*	0.036	2320*	6.25
c	6.306*	0.99*	1.575*	14.74*	561.45**	394.5*
d	0.27	0.448**	1.05**	16.95*	650**	1.36
ab	0.056	0.364**	0.336**	0.63	542.9**	6.34
ac	1.347	0.105	0.21	8.38*	207.115	218.2*
ad	1.914	0.042	0.13	2.03	168.6	11.45
bc	0.597	0.37***	0.727**	1.72	49.8	5.59
bd	5.149**	0.70**	0.37**	1.324	110.28	0.69
cd	0.715	1.244*	0.065	0.63	60.995	6.03
experimental error	0.8135	0.097	0.136	1.33	117.3	17.41

*significant at 99%

**significant at 95%

As rotor speed increases yarn irregularity increase, where for 20 and 26 Ne the more irregular yarns were produced at rotor speed of 52000 r/m.This may be due to the changes in the ratio of the speed of the fibers delivered to the rotor, to the rotor surface speed. Although the collecting surface must move faster than the approaching fibres to straight the fibres. As rotor speed increases the velocity differences increases and the possibility of fiber to skid and to disrupt the orderliness of fibers in rotor increases. This is in agreement with the results, of carded yarns only, at Barella and his coworkers finding (4).

For combed yarns, increasing rotor diameter from 40 to 46 mm tends to improve yarn uniformity. This may be explained by the possibility of lower wrapper fibers. Where as rotor diameter increases the possibility of forming wrapper fibers decreases

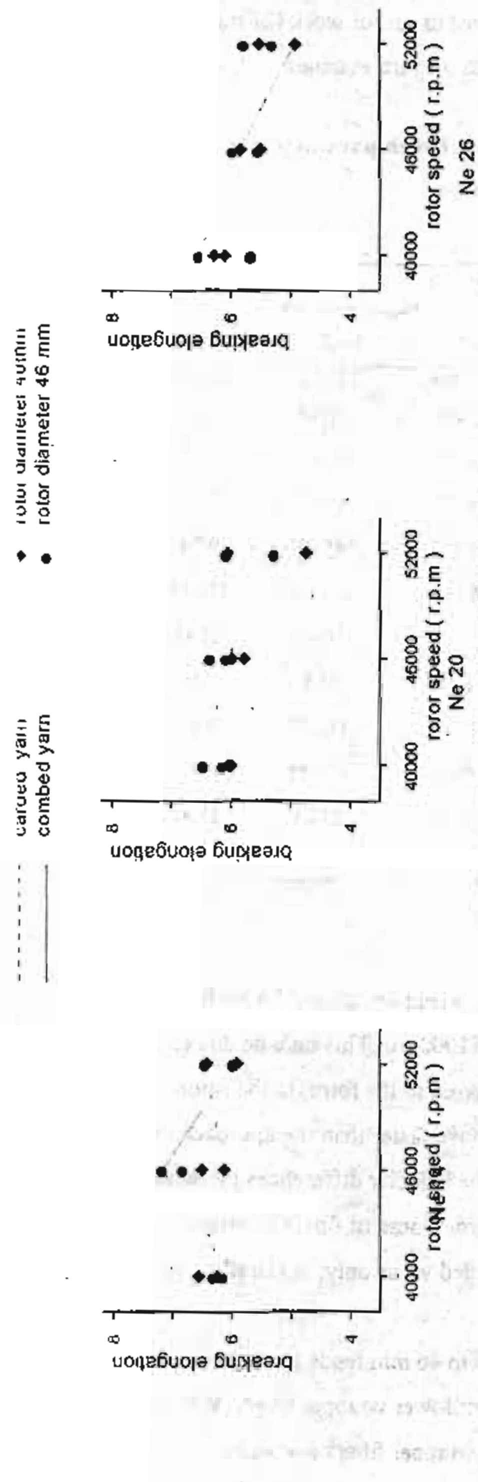

FIG. (2-a) EFFECT OF SLIVER PREPARATION, ROTOR DIAMETER AND ROTOR SPEED ON YARN ELONGATION

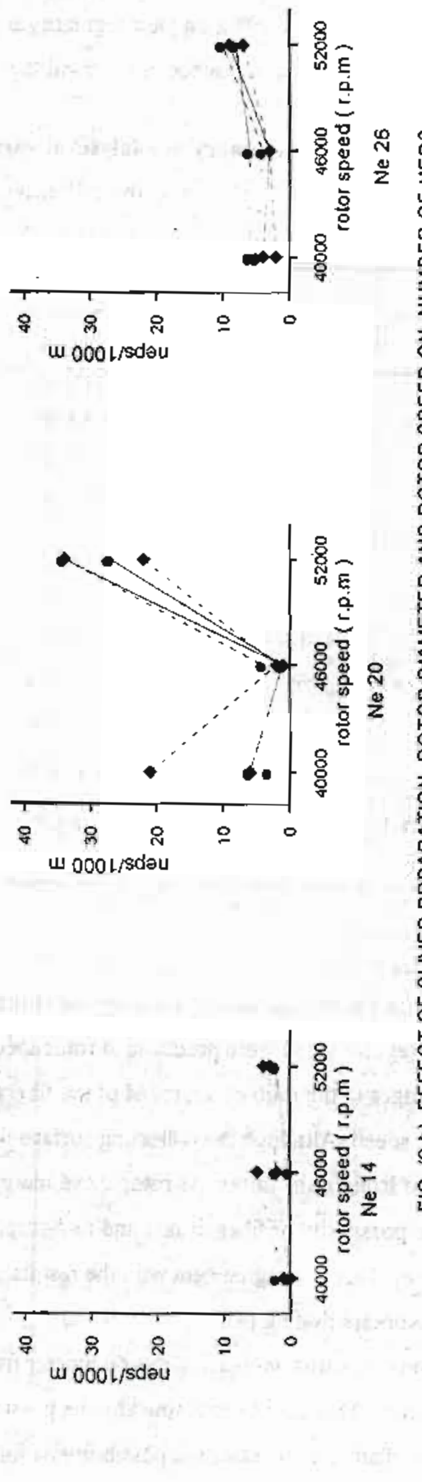

FIG. (2-b) EFFECT OF SLIVER PRPARATION, ROTOR DIAMETER AND ROTOR SPEED ON NUMBER OF NEPS

FIG. (2)

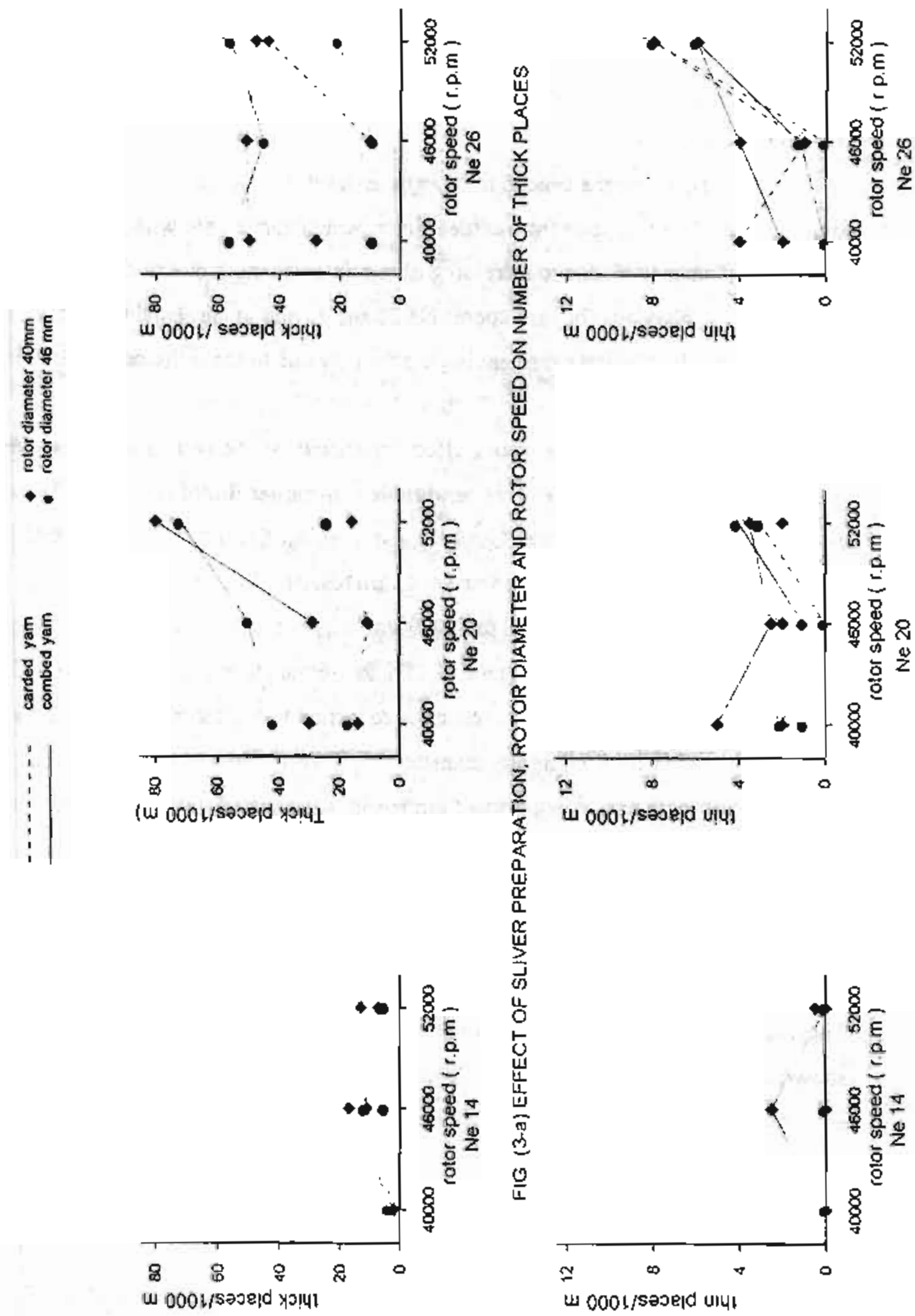

FIG (3-a) EFFECT OF SLIVER PREPARATION,ROTOR DIAMETER AND ROTOR SPEED ON NUMBER OF THICK PLACES

FIG (3-b) EFFECT OF SLIVER PRPARATION, ROTOR DIAMETER AND ROTOR SPEED ON NUMBER OF THIN PLACES

FIG. (3)

3-2- Yarn Tenacity

Sliver preparation and rotor speed significantly affect yarn tenacity at 99%. The interaction between sliver preparation and rotor speed has asignificant effect at 95%, as shown in table (II).

As shown in fig.(1-b), the general trend yarn tenacity is better for yarns spun from combed sliver than that spun from carded sliver, which comfirable with the earlier finding (2). This may be due to increasing fibre effective length due to combing. This phonomenan is obavious for yarn counts Ne 20 and 26 and in agreement with the previous work (1). The improvement in yarn tenacity due to the influence of combing is higher at lower rotor speed.

Higher rotor speed has a negative effect on tenacity of combed yarn (20 and 26 Ne) and of carded yarn (26 Ne).This comfirable with earlier finding (5), (7) , (8). On the other hand, it is in contrary to Grosberg and Mansour finding (6). As yarn gets finer, increasing rotor speed deteriorates the yarn tenacity. Where for 26 Ne yarn, increasing rotor speed from 40000 to 52000 r/m, causes fall in carded yarn strength about 24% for 40 mm rotor diameter and 15% for 46mm rotor dia.. While for combed yarn, increasing rotor speed causes reduction reduction in yarn strength about 21% for 40mm. And 11.2% for 46mm rotor diameter respectively. So it may conclude that, drop in yarn stength due to increasing rotor speed is associated with carded yarns and smaller rotor diameter.

3-3- Breaking Elongation

Breaking elongation is significantly affected by rotor speed and rotor diameter. There is no significant difference between carded and combed yarn elongation, as shown in table (II) and fig. (2-a). While increasing rotor speed results in deterioration in combed yarn elongation (20 and 26 Ne yarns). The effect of rotor diameter on yarn elongation is not obavious.

3-4- Yarn Imperfections

Nep count is significantly affected by yarn count, rotor epeed and their interaction. Maximum nep count was found at 52000r/m rotor speed. For 20 Ne yarn, shown in fig. (2-b), the effect of rotor speed is clear, where, a drop in nep count as rotor speed increases from 40000 to 46000 r/m.followed by a sharp increasing in nep count as rotor speed increases to 52000r/m.

As shown in fig. (3-a), as yarn gets finer, combed yarns contain thick places more than carded yarns (20 and 26Ne). Also increasing rotor speed insreased number of thick places in some cases.

Rotor diameter, rotor speed and the combind effect of yarn count with rotor speed influenced number of thin places significantly at 99% level,as shown in table (II). Figure. (3-b) shows that, as yarn gets fine the influence of rotor speed on number of thin places increases. For 26 Ne, the maximum number of thin places was found at rotor speed of 52000r/m. . At lower rotor speed, increasing rotor diameter reduced number of thin places

4-CONCLUTION

The study reported above permits the following conclutions to be established.

Sliver prepartion influences yarn irregularity, tenacity and thick places. Combing process increased yarn regularity and number of thick places and improved yarn tenacity. It does not appreciably influence breaking elongation.

As rotor speed increases yarn properties are deteriorated,where,the yarn irregularity becoms worse, the breaking elongation decreases and yarn tenacity decreases. For 26Ne, increasing rotor speed from lower to upper limit causes a drop in carded yarn tenacity equal to 24 and 15% for 40 and 46 mm rotor diameter respectively. While for combed yarn the drop was 21 and 11% for the same rotor diameters. Also yarn imperfections were higher at the upper limit.

As rotor diameter increases, number of thin places is reduced, at lower rotor speed and combed yarns become more regular.

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