

Influence of Yarn Twist on the Quality of Rotor Spun Viscose Yarn

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Keyword: viscose;twist;evenness;strength;elongation;rotor spinning

Abstract: The effect of yarn twist on the quality of rotor spun viscose yarn was assessed by analyzing the quality of 30-branch viscose yarn with different yarn twist. The results show that yarn twist has little effect on the quality of the viscose yarn, but excessive low twist will increase the breakage rate.

Introduction

In the traditional cotton spinning industry, yarn twist has tremendous effects on the quality of yarn, especially while the twist decreases, the strength of yarn decreases greatly, which will increase the difficulty of spinning. At the same time, in order to improve the yarn performance, the yarn twist has to increase, at the expense of production, to ensure the normal operation. In recent years, with the rise of the viscose market, more and more spinning mills have turned their production from cotton-based products into viscose-based, using the same cotton production experience as guide for viscose. However, due to the differences in material types, whether there are any differences between cotton and viscose and how such differences could affect the process design are unknown. In this paper, yarn twist as the main process parameter was studied and its influence on yarn quality was accessed.

Experiment

Materials. Raw materials are made by drawn sliver produced by different viscose fiber .Use the most proven BD448 rotor spinning machine. The quality parameters of raw material are shown in Table 1.

Table 1. The quality parameters of raw

Raw material	Quality
Viscose 1	100% CV; 1.1dtex; 38mm
Viscose 2	100% CV; 1.33dtex; 32mm

Spinning process design. According to the process requirement and test purpose, design flow chart of the experiment in Fig.1

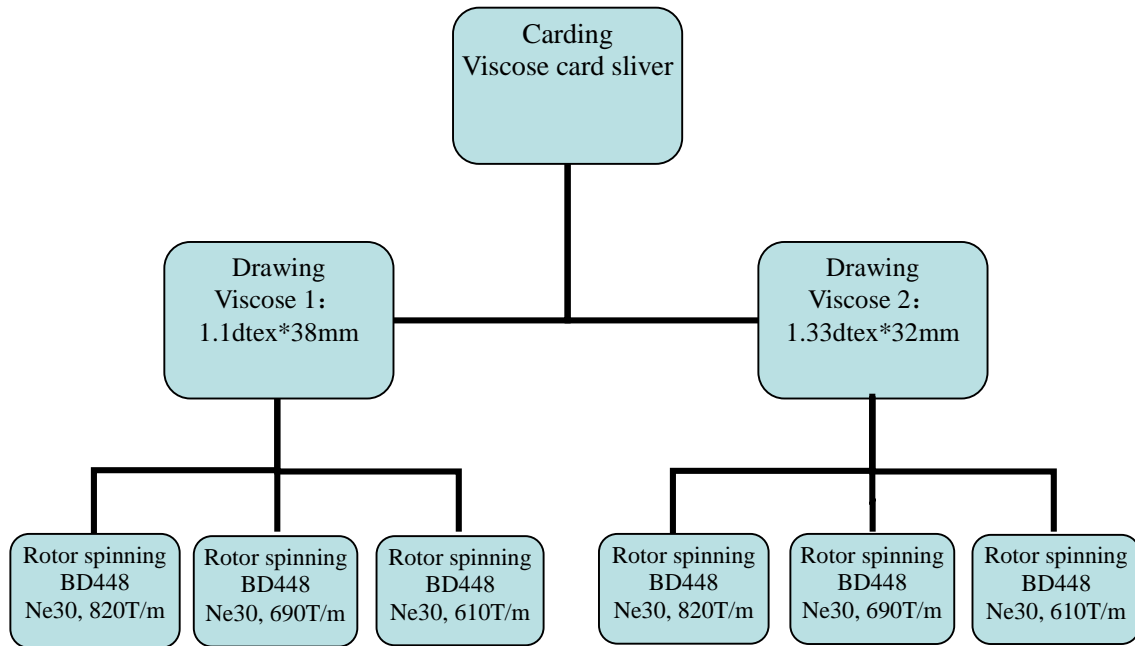


Fig.1 The flow chart of experimental design

Rotor spinning process settings. The most representative Ne 30 viscose is selected in this experiment to ensure the accuracy of the experimental data as far as possible. Two types of materials are chosen, the specific process Settings are shown in Table 2.

Table 2 Rotor spinning process Settings

Yarn count	30	30				
Raw material	1.viscose 1.1dtex*38mm	2.viscose 1.33dtex*32mm				
Rotor spinning machine	Semi-automatic BD 448	Semi-automatic BD 448				
Rotor speed rpm	100000	100000				
Rotor type	T34BD	T34BD				
Carding roller speed rpm	9000	9000				
Carding roller type	OK40 NiDi	OK40 NiDi				
Twist stopper	R4KS5	R4KS5				
False twister	BCK3	BCK3				
Twist /T/m	820	690	610	820	690	610

Measurement instruments and methods. Yarn breaking strength and breaking elongation were tested by YG020B yarn strength tester, according to the national standard GB/T3916-2013. Yarn evenness and hairiness were tested by USTER4.

Results and Discussion

The results of rotor spinning viscose yarn quality test are shown in Table 3.

Table 3 Rotor spinning viscose yarn quality testing

The serial number	1	2	3	4	5	6
Spindle number	10	10	10	10	10	10
Types of materials	1	1	1	2	2	2
Yarn count [30]	30	30	30	30	30	30
Sliver Tex [tex]	5000	5000	5000	5000	5000	5000
Twist factor [αe]	3.8	3.2	2.8	3.8	3.2	2.8
Twist [T/m]	820	690	610	820	690	610
Rotor type	T34BD	T34BD	T34BD	T34BD	T34BD	T34BD
Rotor speed [rpm]	100000	100000	100000	100000	100000	100000
Doffing speed[m/min]	122	144.9	163.9	122	144.9	163.9
Carding roller type	OK40NiDi	OK40NiDi	OK40NiDi	OK40NiDi	OK40NiDi	OK40NiDi
Carding roller speed [rpm]	9000	9000	9000	9000	9000	9000
Twist stopper	R4KS5	R4KS5	R4KS5	R4KS5	R4KS5	R4KS5
Doffing tube plug-in	BCK3	BCK3	BCK3	BCK3	BCK3	BCK3
Channel plate	100	100	100	100	100	100
Process negative pressure [-Pa]	4600	4600	4600	4600	4600	4600
Separating negative pressure [-Pa]	900	900	900	900	900	900
ends down	0	0	2	0	0	1
ends down/millenary spindle hours[/kRh]	0	0	197	0	0	98.5
Test data						
Evenness [CV%]	12.44	12.6	12.64	13.44	13.4	13.44
-30% thin[/km]	1223	1350	1382	2011	2001	1934
-50% thin[/km]	1	1	2	7	5	7
+35% thick[/km]	176	194	199	361	334	369
+50% thick[/km]	9	10	7	23	22	25
+200% nep[/km]	23	24	16	31	26	21
+280% nep[/km]	3	2	1	1	1	0
Hair (Uster)	3.74	3.94	3.99	4	4.21	4.32
Breaking strength[cN]	259.24	267.2 4	272.09	237.59	255.9	259.3
Breaking tenacity[cN/tex]	13.16	13.57	13.81	12.06	12.99	13.16
Breaking tenacity[CV%]	6.95	10.05	7.68	7.98	7.79	8.02
Extension at break[%]	11.86	11.8	11.91	11.01	11.45	12.05
Extend at break[CV%]	6.82	8.4	7.48	9.91	8.98	8.27

Yarn tensile properties influenced by the twist.

As you can see from Fig.2, the yarn twist does not affect the strength and extension of Ne 30 viscose yarn a lot, to the opposite, with the decrease of the twist, the strength is slightly higher. Between the different materials, the strength and extension of the raw material 1 is all better than the raw material 2.

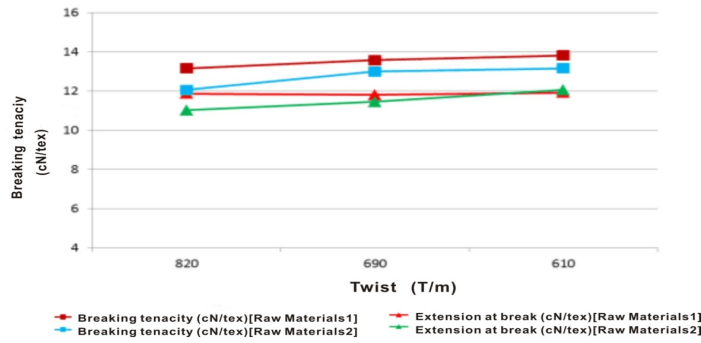


Fig.2 The influence of twist on the Strength and extension of rotor spinning viscose yarn

Yarn count and hair influenced by twist.

As you can see from the Fig.3, the evenness CV and hair of yarn have no difference with the decrease of twist. But, the evenness CV of raw material 1 is smaller than the raw material 2, the same to hair.

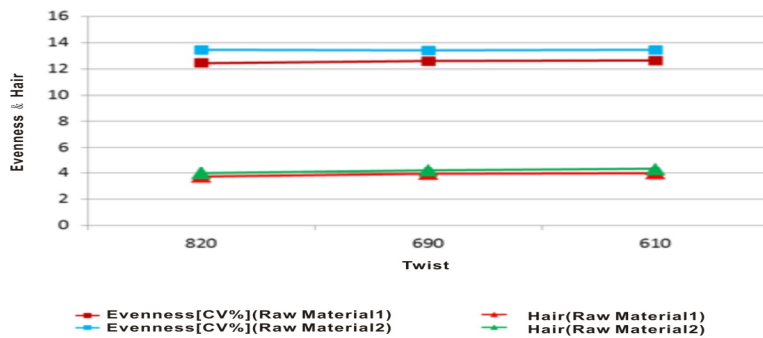


Fig.3 The influence of twist on the evenness CV and hair of rotor spinning viscose yarn

Yarn thick and thin and nep influenced by twist.

As shown in Fig.4, obviously, the yarn thin has no difference with the decrease of twist. However, the number of -30% thin of raw material 1 is significantly less than the raw material 2. as for -50% thin, the number is too small to Characterize the difference of the raw material.

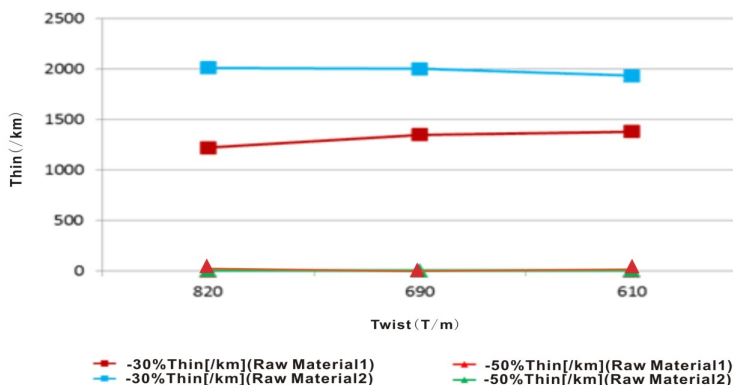


Fig.4 The influence of twist on the thin of rotor spinning viscose yarn

As shown in Fig.5, the thick and thin places of yarn and the nep do not have obvious changes as the change of twist. However, the thick of raw material 1 is obvious less than raw material 2. Moreover, Due to the less nep number, the nap of raw material 1 and raw material 2 does not

change significantly in this experiment.

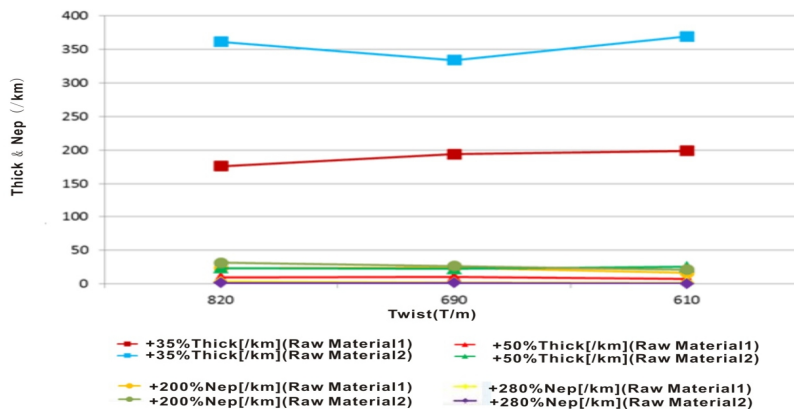


Fig.5 The influence of twist on the thick and nep of rotor spinning viscose yarn

Conclusion

According to the above test results, we obtain some conclusions as follows:

Between different twist, the yarn strength does not fall when the twist reduces from 820T/m to 610T/m. Reducing the twist factor even raise the strength of 100% viscose yarn in some cases. The spinning stability is not significantly influenced when the twist reduces from 820T/m to 610T/m. More fine denier viscose fiber, for example, dtex from 1.33dtex to 1.33 dtex, will significantly improve the quality of yarn such as irregularity of the yarn fineness, yarn strength, the thick and thin places of yarn. Lower twist can get higher yields (Improving the winding speed).

Between different materials, more fine denier viscose fiber has great impact on the yarn strength and elongation. More fine denier viscose fiber can dramatically improve the yarn evenness and hairiness. More fine denier viscose fiber will reduce the nep, the thick and thin places of yarn.

In conclusion, the spinning mill production for 100% viscose yarn, should try to reduce the twist on the premise of ensuring the machine efficiency, so that the production has been greatly increased without negative impacts. And, If the customer requires high yarn quality, The mill should try to choose more fine denier viscose fiber for the cases with a little difference in material price, that has obvious improvement of yarn quality, and will get twice the result with half the effort.

Acknowledgements

This work was financially supported by the Jiangsu Overseas Research & Training Program for University Prominent Young & Middle-aged Teachers and Presidents to assist in Research abroad.

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