# Influence of spinning parameters on vortex spun yarn properties essay

What is Vortex Spinning? Vortex spinning can be viewed as a refinement of jet spinning, or a natural development in fasciated yarn technology.

An entirely new technology “ to spin yarn with the vortex flow of compressed air” created VORTEX; a quite new type of yarn. As in all other fasciated yarns, the structure of vortex yarn consists of a core of parallel fibers held together by wrapper fibers. The main difference between the air jet and vortex yarn is the number of wrapper fibers which is much higher in vortex yarns. In air jet spinning, only the edge fibers become wrapper fibers. In vortex spinning, on the other hand, the fiber separation from the bundle occurs everywhere in the entire outer periphery of the bundle. It is very likely that during yarn formation the leading part of the fibers will not be able to escape from the false twist penetrating upwards and eventually become located in the core.

The trailing parts, on the other hand, will not receive twist and become wrapper. In 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. This technology is not applied to any limited material, but produces the VORTEX yarn with a unique structure through VORTEX spinning regardless of materials.

Vortex spinning has too many advantages, such as high production speed up to 400 m/min, better yarn properties like “ ring-like” structure, low hairiness, reduced fabric pilling, better abrasion resistance, higher moisture absorption, better color-fastness and fast drying. Which parameters affects to the yarn

structure? There are several parameters that affects to the yarn structure. They are nozzle angle, nozzle pressure, spindle diameter, yarn delivery speed and distance between the front roller and the spindle. Basal and Oxenham are made an investigation, and in that study, they changed these parameters one by one and observed the results on the yarn structure. They noticed that little differences in these parameters makes great differences on the yarn structure.

They used cotton fibers with an upper half mean value of 1. 44 and micronaire value of 3. 4 for the study. Test Results Nozzle Air (kg/cm^2)Speed (m/min)FR to SP (mm)Sp Type (mm)Nozzle TypeCVm%Thin PlacesThick PlacesNepsHairinessTenacity (gf/den)Elongation 4.

35020. 51. 26513. 450154222. 54.

1752. 226. 05 4. 535020. 51. 27013.

450130192. 53. 842. 2056. 19 4. 538020.

51. 26513. 42501892094. 8552.

2256. 15 4. 538020. 51.

27013. 6250. 5178. 51774. 262.

26. 31 4. 535020. 51.

36513. 450. 5148. 5218.

54. 712. 2656. 47 4.

535020. 51. 37013. 42511322144. 0952.

1856. 45 4. 538020. 51. 36513.

750. 5205211. 55. 362. 156. 55 4.

538020. 51. 37013. 4750163. 51944. 72.

186. 64 4. 535019. 61. 26513. 2152931833.

7852. 266. 28 4. 535019. 61.

27012. 375055146. 53. 6252. 176.

26 4. 538019. 61. 26513.

380151. 5184. 54. 242. 346.

29 4. 538019. 61. 27012. 315084. 51463.

9552. 2156. 66 . 535019. 61. 36513.

2751901594. 182. 266. 34 4.

535019. 61. 37012. 415065169. 53. 8352.

226. 59 4. 538019. 61. 365Spinning Was Not Possible 4. 538019.

61. 37012. 42088142. 54. 282.

166. 67 535020. 51. 27013. 6851152.

51983. 672. 26. 57 535020. 51.

26513. 4401652053. 9252. 1556.

45 538020. 51. 27013. 40. 51911764. 012.

176. 09 538020. 51. 26513.

540. 52012034. 5252. 265.

83 535020. 51. 37013. 501241593. 9352. 0856.

67 535020. 51. 36513. 120138195. 54. 0952.

236. 85 538020. 51. 37013. 52511871884.

332. 216. 22 538020. 51.

36513. 330148204. 54. 9952. 176. 32 535019.

61. 27012. 360591513. 532. 036. 47 535019.

1. 26513. 145096177. 53. 622.

2156. 31 538019. 61. 27012. 3088139. 53.

7452. 1956. 13 538019. 61.

26513. 270141175. 54. 0052.

215. 95 535019. 61. 37012. 5063.

51713. 7152. 21 535019. 61. 36513.

410. 5119. 5194. 53.

932. 27 538019. 61. 37012. 360.

584136. 53. 982. 1956. 04 538019.

61. 36513. 250. 51191244. 6252.

26. 22 Nozzle Air (kg/cm^2)Speed (m/min)FR to Sp (mm)Sp TypeNozzle TypeMean fiber positionMean migration intensityR. M. S. Migration FrequencyHelix AngleYarn diameterHelix Diameter 4. 535020.

51. 2650. 3001070. 2803570.

1982792. 09313219. 895140. 2257210. 109471 4. 535020.

51. 2700. 2458570. 2948210. 753642.

53827520. 434950. 2435140. 105686 4.

538020. 51. 2650. 2530070.

2683430. 1820572. 18344620. 15990. 267650.

1124 4. 538020. 51. 2700.

2493640. 2765210. 1763932. 37251519. 346920. 2508860.

101114 4. 535020. 51. 3650. 29270. 27290.

1811642. 36688220. 293530. 2447430. 109621 4.

535020. 51. 3700. 2873360. 2954790.

2115642. 08171820. 399430. 2222210.

102129 4. 538020. 51. 3650. 281950. 2433710.

1850572. 01097720. 255790. 2800860.

131893 4. 538020. 51. 3700.

2599140. 2679930. 1852362. 2301619. 381620. 2323930.

105057 4. 535019. 61. 2650. 2733430.

262550. 1729432. 39291719. 915960. 2432860. 105179 4.

535019. 1. 2700. 2570210.

2831070. 1889572. 22635619. 84550.

2315790. 101207 4. 538019. 61.

2650. 2626430. 2700570. 1915862. 14352819. 44280.

2473790. 106986 4. 538019. 61. 2700. 2522640.

2871210. 1924432. 16063419. 561090. 2510710.

103057 4. 535019. 61. 3650. 272050. 23880.

1884291. 86161418. 339090. 2423070. 106014 4.

535019. 61. 3700. 2413710. 2972930.

1690572. 64228820. 053890. 2444290. 100464 4. 538019.

61. 365Spinning Was Not Possible 4. 538019. 61. 3700. 2811570.

2901640. 1867292. 37411820. 182730. 2310710. 102443 535020.

51. 2700. 2532710. 276250. 1780072.

3413919. 889180. 2326210. 09695 535020.

51. 2650. 623210. 2834860. 1922572. 19411420.

127770. 2277290. 101507 538020. 51. 2700. 3004790.

3155640. 1981862. 35604921. 118540.

2251710. 104771 538020. 51. 2650. 2593210.

2573710. 1702792. 2351118. 731020.

2146710. 097029 535020. 51. 3700. 2824360. 3176140.

1946142. 4871821. 448870. 2214930. 099107 535020. 51.

3650. 2794860. 2863860. 1823072. 40846120. 829610.

2491140. 111379 538020. 51. 3700.

2652570. 2840790. 1933212. 22257819. 695360.

2559640. 104 538020. 51. 3650. 2731710. 2591290.

1936142. 04344319. 552840. 2412930. 109136 535019. 61.

2700. 2767140. 3649210. 1724213. 20077320. 918740.

2318360. 098836 535019. 1. 2650.

3112640. 3303570. 1851292. 62004521. 349860. 2266570. 104236 538019. 61. 2700. 2664070. 2775790. 19552. 14046519. 945660. 229850. 098343 538019. 61. 2650. 2701430. 2546860. 2082791. 81355120. 204070. 2463290. 109814 535019. 61. 3700. 24690. 3075790. 1904292. 42467120. 745760. 2388430. 100057 535019. 61. 3650. 3260930. 274750. 193752. 12796221. 372110. 2297210. 117086 538019. 61. 3700. 2645360. 2819140. 1826792. 35619920. 404160. 2484640. 105457 538019. 61. 3650. 2394430. 2534290. 1935572. 04344918. 791690. 2547710. 103793 %CVmThinsThicksNepsHairinessElongation (%)Tenacity Noz. airNsNsNsNsSNsNsSpeedNsNsSNsSNsNs FR to SpSNsSSSNsNs Noz. angSNsNsNsSNsNs Sp diaNsNsNsNsSNsNs Noz. air * SpeedNsNsNsNsNsNsNs FR to Sp * Sp dia. NsNsNsNsNsNsNs FR to Sp * Noz angSNsNsNsNsNsNs Sp dia. * Noz angNsNsNsNsNsNsNs Noz. air * FR to SpNsNsNsNsNsNsNs Noz. air * Sp dia. NsNsNsNsNsNsNs Noz. air *Noz. angNsNsNsNsNsNsNs Speed * FR to SpNsNsNsNsNsNsNs Speed * Sp dia. NsNsNsNsNsNsNs Speed * Noz. angNsNsNsNsSNsNs FR to Sp * Sp dia * Noz ang. NsNsNsNsNsNsNs Noz air * FR to Sp ‘ Sp diaNsNsNsNsNsNsNs Noz air * FR to Sp * Noz angNsNsNsNsNsNsNs Noz air * Sp dia * Noz angNsNsNsNsNsNsNs Speed * FR to Sp * Sp diaNsNsNsNsNsNsNsSpeed * FR to Sp * Noz angNsNsNsNsNsNsNs Speed * Spdia * Noz angNsNsNsNsNsNsNs Noz air * Speed * FR to SpNsNsNsNsNsNsNs Noz air * Speed * Noz angNsNsNsNsNsNsNs Noz air * Speed * Sp diaNsNsNsNsNsNsNs Mean fiber positionMean migration intensityEquivalent migration frequencyR. m. s deviationYarn diameterHelix angleHelix diameter Noz. airnssnsnsnsnsns Speednsssnssnsns FR to Spnsnsnsnsnsnsns Noz. angnsssnsNsnsns Sp diansnsnsnsNsnsns Noz. air * SpeednsnsnsnsNsnsns FR to Sp * Sp dia. nsnsnsnsNsnsns FR to Sp * Noz

angnsnsnsnsNsnsns Sp dia. * Noz angnsnsnsnsNsnsns Noz. air * FR to SpnsnsnsnsNsnsns Noz. ir * Sp diansnsnsnsNsnsns Noz. air * Noz. angnsnsnsnsNsnsns Speed * FR to SpnsnsnsnsNsnsns Speed * Sp diansnsnsnsNsnsns Speed * Noz. angnsnsnsnsNsnsns Noz air * Speed * FR to SpnssnsnsNsnsns Noz. air: nozzle pressure; Speed, yarn speed; FR to Sp, distance between the front roller and the spindle; Noz. ang, nozzle angle; Sp dia, spindle diameter; s, significant; ns, not significant; s = p ; 0. 05. Explanations Shorter distance between front roller and the spindle provides more even yarns and less hairiness, but the effect of the nozzle angle on the hairiness is higher than distance of front roller to spindle. Higher nozzle angle results in better hairiness and evenness values. When these two parameters set together, better yarn evenness will be achieved. Both of the nozzle pressure and spindle diameter affect only hairiness. High nozzle pressure and smaller spindle diameter return as better hairiness values. Yarn delivery speed has a significant effect on the forming of thick places and hairiness. Lower delivery speeds caused less thickness and hairiness. At higher speeds, the occurrence of the thick places will increase. The combination of the yarn delivery speed and nozzle angle has a big effect on hairiness. The distance between the front roller and the spindle is critical since it determines the number of wrapping fibers. Shorter distance caused to tight assemble of the both ends of fibers, resulting in fewer open ended fibers and this results in a yarn consisting of mostly parallel core fibers with fewer wrapper fibers like an air-jet yarn. This time yarn evenness and imperfections are better since there is less chance of losing control of fibers during the bundling of the parallel core fibers, which forms the main part of the yarn with a few wrapper fibers. Furthermore, due to better fiber control

waste is less. Also, the yarn has less hairiness. In other condition, the wrapper fibers increase, and less fiber control. The resultant yarn is softer due to increasing wrapper fibers and has more hairiness with longer hair. The waste fiber rate, however, is higher in comparison with that in short setting. When nozzle pressure increases, both the axial and the tangential velocity increase and the fiber bundle receive