Optimization of Opening Roller Speed on Properties of Open End Yarn

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Abstract
An experiment conducted to spun 6’s, 12’s count on well-maintained open end machine by changing opening roller speed i.e.,7000 and 8000 rpm. Present investigation reveals that, as increases opening roller speed yarn properties Like Rkm, Unevenness, total IPI improved, but there is marginal improvement in U% and RKM, and drastic reduction in total IPI, of the both yarn count. Investigation also summarized that as increases opening roller speed the cleaning intensity increases, deposition of trash in rotor groove increases leads to increase end breakages for both count. For reducing the end breakages frequency of cleaning rotors were suggested. This study also gives the difference between the properties of yarns which are produced from two different opening roller speeds. The quality parameters of the yarns produced were evaluated on an Uster Evenness Tester, the Uster Tensorapid with a testing speed of 250 mm/m and the UT4 with a testing speed of 400 mm/m.

Keywords: Opening roller speed; IPI; Unevenness; Rkm; Uster tensorapid; Uster tester

Introduction
New spinning technologies introduced in late sixties and early seventies, only rotor spinning sustained its promise and in the years to follow, it established itself as a worthy alternative to ring spinning in the course and medium count range [1-3]. The reasons for its phenomenal growth were very high productivity, around 5-8 times that of ring system, and amenability to automation and elimination of roving and winding process [3-5].

Today rotor yarns account for 30% of total spun yarn production and 23% of equivalent ring spindle installation in the world is on rotor spinning. Despite these breath taking achievements, the Indian textile industry has not responded adequately to it. The total number of rotors installed in India till date amount to less than a lac accounting for less than 2% of equivalent ring spindle installation and 10% of total spun yarn production. The yarns normally produced are 4’, 6’ and 10’ cotton yarns for end products like carpet backing,ropes, bed sheets, cycle tyre card and 7s, 8s and 10s for denim some of these yarns are also cotton yarns for end products like carpet backing, ropes, bed sheets.

Experimental Plan
6’s, 12’s carded cotton yarn was spun at an open end machine at speed of 65000 and 105000 rpm. Trials were conducted at open-end machine by changing speed of opening roller speed 7000 rpm and 8000 rpm on well-maintained rotor spinning machine schlafhorst Autoscore SE9288. One passage of draw frame material processed, through open-end machine to determine effect opening roller speed on yarn quality in rotor spinning (Table 1). Usually imperfection, (thick, thin, neps) and short term evenness (U%) of yarn rather than length, strength are influenced by the changes in opening roller speed, adopted for large-scale working in spinning department. The mean breaking force of the yarn was measured using a standard Tensorapid tensile tester. The CV% of the yarn mass was tested with a uster Evenness tester, to analyze the effect of opening roller speed (Figure 1).

Result and Discussion
Present investigation summarized from Tables 2-4 and Figures 2-3

| Rotor diameter | 36 mm | 36 mm |
|----------------|-------|-------|
| Opening roller diameter | 60 mm | 60 mm |
| Rotor speed | 65000 rpm | 1,05,000 rpm |
| Opening roller speed | 7000/8000 rpm | 7000/8000 rpm |
| Draft | 57.2 | 114.8 |

Table 1: Machinery specifications.

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As the opening roller speed increases, the carrying factor (i.e., the effective number of wire points per unit time) increases, which in turn increases the opening efficiency of the opening roller. Owing to the better opening of fibres, it can be observed that, the fibre tufts of smaller size and uniform dimensions are fed into the transport tube and fibre orientation and sufficient drafting and doubling takes place in rotor groove which leads to improve Rkm value and reduction in unevenness and coefficient of variation of both counts (Table 2).

It was also observed during experimentation, A yarn break with a trash particle embedded end increases in the case of both yarn, because the high feed rate of fibre at the rotor groove causes the flow of trash particles to accelerate; thus, the chances of the suction tube choking will be higher, and this will allow trash particles to go along with the fibre on the rotor surface, causing end breakages increase in open end spinning for both count (Table 3).

Conclusions

Present investigation summarized as follows, as opening roller speed increases from 7000 to 8000 rpm for both count, quality parameters such as Rkm value, unevenness, Total IPI improved this because of intensity of opening action and trash particles were removed. It was also noted in experiment a yarn breaks increases with a trash particle embedded in the rotor groove, because the high feed rate of fibre at the rotor groove causes the flow of trash particles to accelerate; thus,

Table 2: Shows hank organization and draft.

| Count   | 6's       | 12's     |
|---------|-----------|----------|
| Rotor speed | 65000 rpm | 105000 rpm |
| Rotor type  | T336      | T336     |
| Silver hank | 0.105     | 0.105    |
| Draft     | 57.2      | 114.8    |
| TM        | 5.2       | 5.3      |
| TPM       | 501       | 727.8    |
| Package length | 31 Km    | 77 km    |

Table 3: Shows process parameters of the open end spinning.

| S.no | Yarn parameters for 6's count | Opening speed 7000 rpm | Opening speed 8000 rpm | Yarn parameters for 12's count | Opening speed 7000 rpm | Opening speed 8000 rpm |
|------|-------------------------------|------------------------|------------------------|-------------------------------|------------------------|------------------------|
| 1    | RKM                           | 11.66                  | 12.16                  | RKM                           | 11.51                  | 11.41                  |
| 2    | U%                            | 9.89                   | 9.66                   | U%                            | 11.34                  | 11.01                  |
| 3    | IPI                           | 13.05                  | 10.73                  | IPI                           | 120.97                 | 87.87                  |
| 4    | CV%                           | 1.42                   | 0.85                   | CV%                           | 1.11                   | 0.98                   |

Table 4: Shows Yarn testing parameters for 6's and 12's count.
the chances of the suction tube choking will be higher, and this will allow trash particles to go along with the fibre on the rotor surface, causing end breakages increase in open end spinning for both count. End breakages rates reduced by the increasing the frequency of rotors cleaning.

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