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Research paper

Importance of spindle speed in ring frame

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Abstract

In textile industries, spinning sector plays a vital role because this sector produces the main raw material for the textile industries which is known as yarn. So for getting good qualities garments, it is needed to ensure the good qualities yarn. There are many things which are responsible for producing good qualities yarn. Among these spindle speed is an important thing. One must have to change the spindle speed, when he changes the count. As every count has a particular spindle speed in which the production shows maximum production efficiency. Here we used five most commonly used yarn counts in the maximum factories. The counts are 15 Ne, 20 Ne, 25 Ne, 30 Ne and 40 Ne. We analyzed these counts with different speed and found that every count showed maximum efficiency at a particular spindle speed. The outcome of this paper is applicable in all types of ring frame machine , especially for producing single carded and combed yarn.

Keywords: *Ring frame; RPM of Spindle; Spinning factory; Spindle; Yarn count.*

1. Introduction

The productivity and efficiency of ring frame mostly depends on many factors like traveller, ring diameter, spindle speed etc [1-4]. When high speed spindle is used, it generates fly dust and causes fiber breakage. Hence there is a need fo selecting optimum speed of spindle, where one can get accurate production process as well as product quality [5-8]. On can get good qualities and breakage free production by selecting proper spindle speed [9].The identification of natural frequencies of the spindle because it's very difficult to measure the spindle speed when the spindle is moving at a high speed because there are a few sensors. For solving these problems some methods are used the modes are determined through a 3-step procedure. First, spindle modes are highlighted using the Frequency Domain Decomposition (FDD) technique, with a new formulation at the considered rotating speed. There are many counts variation in ring spinning system. Here I would like to introduce you about most commonly used yarn count like 15 Ne, 20 Ne, 25 Ne, 30 Ne and 40 Ne [10]. Results show a good correlation between numerical and experiment-based identified frequencies. The identified spindle-tool modal properties during machining allow the numerical model to be considered as representative of the real dynamic properties of the system [11]. Ring spinning which uses the Ring frame is the main spinning system is used by 7 in every 8 mills to produce cotton yarns for fabric production by knitting and weaving factories 3. The process of fibre to yarn conversion at the ring frame involves drafting, twisting roving of fibres and winding the spun yarn on the bobbin and is the costliest stage in the spinning process flow contributing 60% of the total cost of yarn production. Every factory wants to reduce the cost of their production for their profit as well as proper utilization of their natural sources [12].

2. Materials and methods

2.1. Materials

For this we use calculator, electric balance, and tachometer. Through the tachometer we measure the individual spindle speed and calculate them for comparing the reading value and electronic monitor value [13-15].

2.2. Methods

For this study we consider 1200 spindles and operate these and carefully monitor these for 7 days. We always try to maintain the all the spinning parameters properly and change only the spindle speed. The results of the work are discussed here with the practical data.

i) Efficiency of ring frame machine at 12000 RPM spindle Speed:

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Table 1: Efficiency Ring Frame Machine at 12000 RPM Spindle Speed

Yarn Count (Ne) when the spindle speed is 12000 RPM	Efficiency %
15 Ne	95%
20 Ne	88%
25 Ne	80%
30 Ne	70%
40 Ne	55%

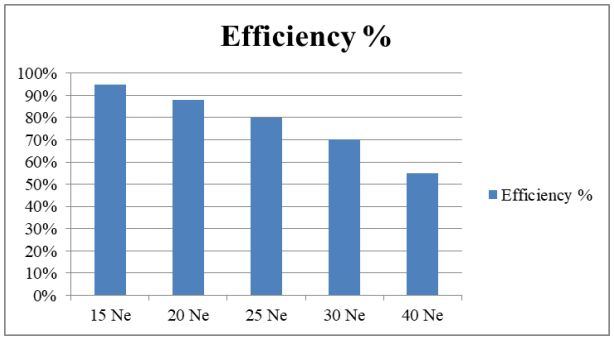

Fig. 1: Efficiency Ring Frame Machine at 12000 RPM Spindle Speed.

Fig. 1 shows the efficiency of ring frame is excellent (around 95%) for 15 Ne count when the spindle speed is 12000 RPM.

ii) Efficiency of ring frame machine at 13000 RPM spindle Speed:

Table 2: Efficiency Ring Frame Machine at 13000 RPM Spindle Speed

Yarn Count (Ne) when the spindle speed is 13000 RPM	Efficiency %
15 Ne	88%
20 Ne	96%
25 Ne	85%
30 Ne	73%
40 Ne	60%

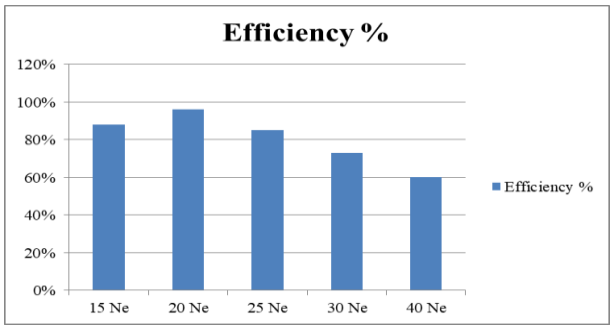

Fig. 2: Efficiency Ring Frame Machine at 13000 RPM Spindle Speed.

Fig. 2 shows the efficiency of ring frame is excellent (around 96%) for 20 Ne count when the spindle speed is 13000 RPM.

iii) Efficiency of ring frame machine at 14000 RPM spindle Speed:

Table 3: Efficiency Ring Frame Machine at 14000 RPM Spindle Speed

Yarn Count (Ne) when the spindle speed is 14000 RPM	Efficiency %
15 Ne	78%
20 Ne	85%
25 Ne	95%
30 Ne	82%
40 Ne	75%

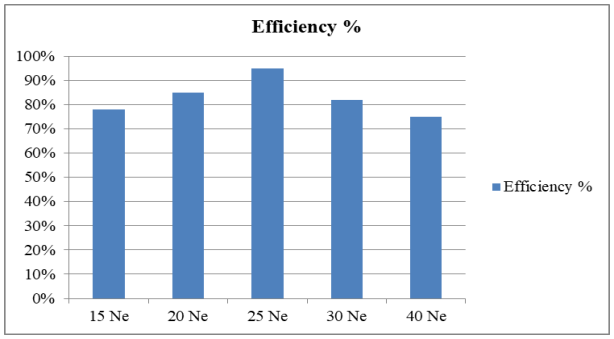

Fig. 3: Efficiency Ring Frame Machine at 14000 RPM Spindle Speed.

Fig. 3 shows the efficiency of ring frame is excellent (around 95%) for 25 Ne count when the spindle speed is 14000 RPM.

iv) Efficiency of ring frame machine at 16000 RPM spindle Speed:

Table 4: Efficiency Ring Frame Machine at 16000 RPM Spindle Speed

Yarn Count (Ne) when the spindle speed is 16000 RPM	Efficiency %
15 Ne	65%
20 Ne	80%
25 Ne	85%
30 Ne	98%
40 Ne	88%

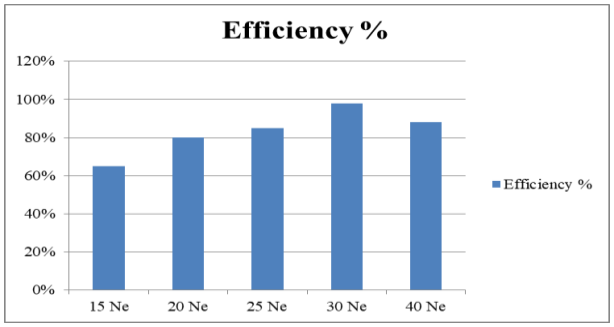

Fig. 4: Efficiency Ring Frame Machine at 16000 RPM Spindle Speed.

Fig. 4 shows the efficiency of ring frame is excellent (around 98%) for 30 Ne count when the spindle speed is 16000 RPM.

v) Efficiency of ring frame machine at 17000 RPM spindle Speed:

Table 5: Efficiency Ring Frame Machine at 17000 RPM Spindle Speed

Yarn Count (Ne) when the spindle speed is 17000 RPM	Efficiency %
15 Ne	55%
20 Ne	70%
25 Ne	80%
30 Ne	90%
40 Ne	95%

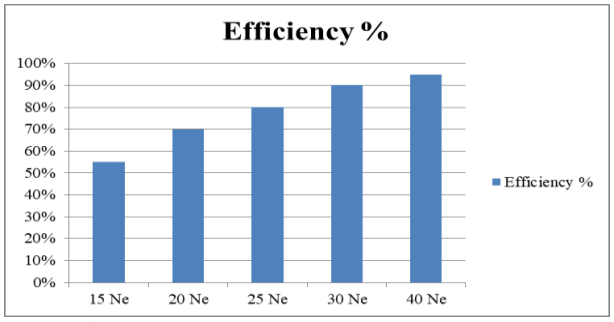

Fig. 5: Efficiency Ring Frame Machine at 17000 RPM Spindle Speed.

Fig. 5 shows the efficiency of ring frame is excellent (around 95%) for 40 Ne count when the spindle speed is 17000 RPM.

From the above values we can see that the speed of spindle of ring frame varies when we change the count. So it is necessary to consider the spindle speed on the basis of yarn count.

We should also consider the idle spindle in the ring frame cause this plays a vital role in the production. Many properties of yarn like hairiness, imperfections, tenacity and elongation produced different spindle speed of the ring frame machine. The hairiness and imperfections also increased when we didn't control the spindle speed properly [16]. The developing country like ours economy 80% depends on the Textile sector and Spinning is the first textile sector. There are 425 spinning mills established in Bangladesh which provide the raw materials yarn to the textile sector. The production of Spinning Mills depends on the production rate of the spindle in ring frame. There are around 12410000 spindles in 425 spinning mills in Bangladesh [19]. The quality of the ring yarn depends on the spindle speed. So the effect of spindle speed of ring frame on yarn quality is very important. In this research we want to highlight the importance of spindle speed [17]. We know that the higher speed of spindle can break the yarn. So we need to maintain the accurate speed [18].

3. Research limitations

Data for the study was collected from Yasmin spinning mills Ltd. Another limitation is we didn't monitor the spindle speed as well as the production in the night shift.

4. Conclusion

The yarn count 15 Ne, 20 Ne, 25 Ne, 30 Ne and 40 Ne shows around 95% efficiency when the spindle speed is at 12000 rpm, 13000 rpm, 14000 rpm, 16000 rpm and 17000 rpm respectively. By using these accurate values for particular yarn count, the speed of production and the quality of yarn can be increased. If factory applies those parameters properly, it can attain better outcome. As Bangladesh imports mostly from other countries, it can't ignore its own good quality yarn production.

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