Volume 3, Issue 11 November 2025 ISSN (E): 2938-3757

OPPORTUNITIES FOR REDUCING THE NUMBER OF NEPS IN CARD SLIVER

Mirzaboyev Jamoliddin Bahriddinovich
Associate Professor, PhD, Department of Textile Industry Technology,
Namangan State Technical University
E-mail: jamoliddin8321@gmail.com; Tel: +99893-494-05-99

Otakhonov Ilkhomjon Odiljon ugli
Master's Student, Department of Textile Industry Technology,
Namangan State Technical University

Abstract
The article analyzes the technical capabilities of carding machines at spinning mills and the properties of card sliver obtained at the enterprise. Conclusions are drawn by comparing the opportunities for reducing the number of neps in the card sliver with standard requirements.

Keywords: Carding machine, sliver, nep, speed, flat, unevenness, short fiber content.

Introduction

In the Decree of the President of the Republic of Uzbekistan No. PF-60 "On the Development Strategy of New Uzbekistan for 2022-2026" [1], tasks are set to "double the production volume of the textile industry products". For such production volumes, the share of saved primary raw materials also constitutes a significant amount of material wealth. One of the goals of the "Program for deep processing of cotton fiber and production of finished textile products..." is "reliable and guaranteed reproducible production of finished products through deep, three-to-four stage processing of raw materials oriented towards the final result." Research aimed at expanding the range of consumer textile products and introducing new machinery and technologies through the proper use of fiber waste is important for fulfilling these tasks.

The light industry, including the textile industry, is a strategically important and rapidly developing sector of the national economy. The comprehensive solution of issues related to the production of textile materials, delivering them to the finished product stage, introducing new machinery and technologies, and making fuller use of local raw materials is one of the main tasks facing the light industry [2, 3, 4].

It is appropriate to note here that significant changes have occurred in recent years in global production practices, in technological processes in the textile and light industries. This made it possible to produce fundamentally new products that meet the most subtle demands of consumers.

Today, spinning enterprises are being equipped with the most modern machinery and equipment from world-famous companies such as "Rieter" (Switzerland), "Trutzschler"

(Germany), "Marzolli", "Savio" (Italy), "Murata", "Toyota" (Japan). To fully master the installed equipment and produce high-quality products, it is necessary to determine the optimal adjustment parameters corresponding to our national raw materials, ensuring efficient use of fibers while preserving their natural quality indicators and maintaining waste standards.

The rapidly developing textile field demanded the application of world practices in deep raw material analysis, resulting in the introduction of testing equipment like HVI [5] and Uster AFIS PRO [6], part of the Uster® system, into textile enterprises, which is now being effectively used.

With the introduction of these testing systems, concepts such as Micronaire (Mic), Maturity, Immature (brittle) Fiber Content (IFC, %), Neps, Short Fiber Index (SFI), Reflectance Degree (Rd,%), Yellowness Degree (+b), Upper Half Mean Length (UHML), (50% Span Length, 2.5% Span Length), Fibrogram, Uniformity Index (UI,%), Unevenness Degree (UR,%), Dust Content and its Size Level (Duct. μm) also entered the main quality indicators of cotton fiber. These indicators, of course, have their impact during the yarn manufacturing process.

Over the last 10 years, we can observe that the practical productivity of carding machines has increased to 80-100 kg/h due to improvements in their design and the advancement of carding technology. The technological scheme of the flat carding machine has remained unchanged since the mid-19th century. All main parts performing the basic technological processes - feed, taker-in, main cylinder - flats, doffer, stripping and sliver formation sections - have been preserved.

Based on the development of carding theory, achievements were made in increasing machine productivity up to 260 kg/h while maintaining sliver quality, through mechanization, automation, product quality control, the use of drafting devices on the card, and improving the machine design by widening the working width.

Although the flat carding machine is considered the final process in the spinning system for cleaning fibers from trash, foreign matter, and defects, impurities and fiber defects are not completely removed. Furthermore, it should be emphasized that the carding machine itself is also a source of additional defects, particularly neps, which reduce the quality indicators of the carded sliver.

In the spinning system, the conventional carding machine is the final process for cleaning fibers from impurities and defects, but to a certain extent, as noted, trash, foreign matter, and short fibers remain in the sliver. Simultaneously with the cleaning of trash and defects from the fiber, a certain amount of waste and spinnable fibers are also separated as waste during the carding process [7].

Thus, the composition of fibers in the carded sliver largely depends on the operation of the carding machine. Studying the factors affecting changes in fiber properties during the carding process is extremely important.

Conducted research has determined that by utilizing the spinnable fibers present in the waste separated from the carding machine, it is possible to achieve efficient use of raw materials at the enterprise [8].

Slight changes in the kinematic parameters of the carding machine, i.e., the speeds of the moving working organs, also have a significant practical impact on obtaining high-quality

Web of Technology: Multidimensional Research Journal
webofjournals.com/index.php/4

carded sliver. Furthermore, adjustment parameters significantly affect carding intensity, fiber damage, and the amount of short fibers and impurities. Therefore, the correct selection of flat speed ensures high quality indicators of the carded sliver and yarn. This research work studied the effect of the carding machine flat speed on the quality indicators of carded sliver and yarn while keeping other machine parameters constant.

At the controlled enterprise, sliver and fiber samples from the carding machine processing type IV, 1st-2nd grade, Sultan selection cotton were tested using laboratory equipment of the AFIS and HVI systems. During the carding process, the movement speeds of the flats on the TS-15 type carding machine were changed in the range of 200, 240, 280, 320, and 360 mm/min, while ensuring other parameters remained constant. Test results are presented in Table 1.

Table 1. Fiber property indicators of cotton fiber determined by USTER AFIS and HVI

Property Indicator Name	Values
Total Neps Count (cnt/g)	265
Micronaire value (µg/in)	4.30
Fiber length, mm 5% L(n)	34.2
Upper Half Mean Length, mm UHML	28.20
Tenacity, g/tex	29.30
Yellowness, Yellowness (+b)	9.28
Reflectance Degree, Reflectance (Rd)	81.22
Maturity Degree, Maturity index	0.82
Uniformity Degree, Uniformity index (%)	81.60
Elongation, Elongation (%)	7.10
Short Fiber Content, Short fiber index (%)	8.77

Technological indicators of the carding process are shown in Table 2.

Web of Technology: Multidimensional Research Journal
webofjournals.com/index.php/4

Table 2. Technological indicators of the carding machine during the carding process

Parameter Item	Indicator Name	Values
Feeder	Sliver layer lap mass, g/m	500-600
Taker-in speed	Taker-in speed, min^{-1}	1250
Cylinder speed	Main cylinder speed, min^{-1}	520
Flat speed	Flat speed, mm/min	200/240/280/320/360
Delivery speed	Delivery speed, m/min	200
Total number of flats in rotation	Number of moving flats	99
Cylinder to flat distance (in five different positions from back to front)	Distance between main cylinder and flats (setting) in five states	state 1: 250 state 2: 250 state 3: 220 state 4: 220 state 5: 200

Yarn samples with English counts Ne 20 (29.5 tex) and Ne 30 (20 tex) were produced from roving with count Ne 0.80. The main indicators of the spinning process are given in Table 3 below.

Table 3. Main technological parameters of the spinning process

ITEM	Name	Indicators	
		Ne30	Ne20
Drawn sliver hank	Sliver count	Ne0.115	Ne0.115
Roving hank	Roving count	Ne0.80	Ne0.80
Twist per meter	Roving twist	44	44
Ring frame speed (RPM)	Spindle speed	17000	16000
Twist per inch	Yarn Twist	19.36	18.21
Drafting arrangement (ring frame)	Drafting system	3 x 3	3 x 3
Draft (ring frame)	Draft	42.85	30.28
Doubling (breaker draw frame)	Doubling 1st passage	6	6
Doubling (finisher draw frame)	Doubling 2nd passage	8	8

Neps and Short Fiber Content (SFC). Tests were conducted on the Uster AFIS laboratory equipment for the number of neps per 1 gram of fiber and the Nep Removal Efficiency (NRE %) for each changed flat speed, and average values were calculated from 10 samples.

Unevenness and Imperfections (IPI). Card sliver samples were produced, and the Uster Tester-5 laboratory equipment was used to determine their unevenness. To determine the sliver unevenness, five sliver cans were randomly selected for each of the five flat speeds, and the unevenness (U%) indicators of 10 samples taken from each can were recorded.
The IPI criterion expresses the total imperfections of the yarn; it is an indicator of the total sum of thick places, thin places, and neps per 1000 meters of yarn. For ring-spun yarn, the IPI indicators are determined for:
Thick places (+50%), Thin places (-50%), Neps (+200%).

Count and Strength. The linear density of the yarn in the obtained sample was determined automatically using the AUTO SORTER-5 laboratory equipment. Also, the strength indicator of the yarns in the sample was determined on the TEXTECHNO testing device. All tests were conducted under standard laboratory conditions, i.e., air temperature 20 ± 2 °C and relative humidity 65 ± 2% [9].

Flat Strippings. The short fibers (SFC) and impurities separated between the main cylinder and the flat are called "**flat strippings**". Fibers deeply embedded between the flat wires that are not stripped by the serrated clothing wound on the main cylinder surface also go into the flat strippings.

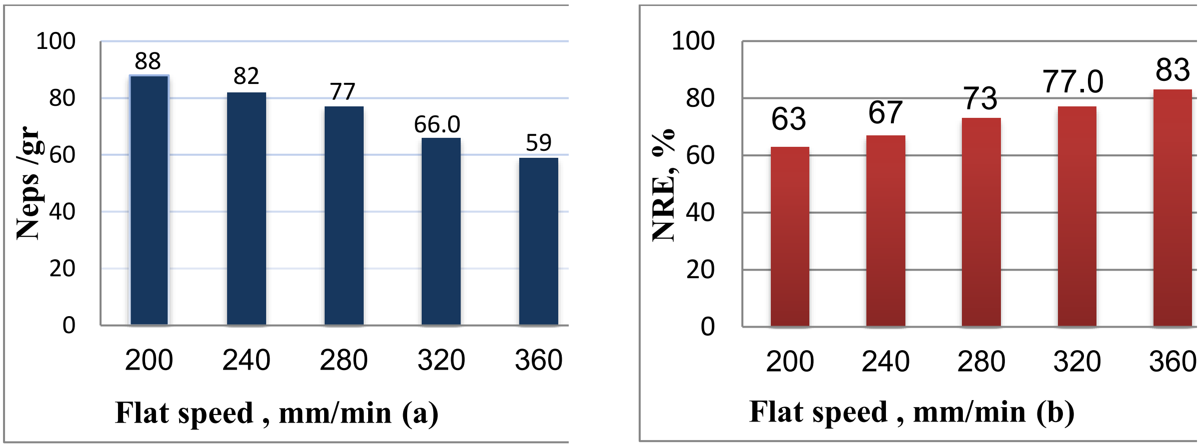

Figure 1. Effect of flat speed on nep removal intensity (NRE%)

Number of Neps in Card Sliver and Nep Removal Efficiency (NRE%). Figure 1 (a) and (b) show the values for nep content in the card sliver and the NRE% share for different flat speeds. It was found that as the flat speed increases, the nep content decreases, and the nep cleaning efficiency of the machine increases. At flat movement speeds of 200, 240, 280, 320, and 360 mm/min, the nep content per unit mass was 88, 82, 77, 66, 59 and the NRE% share was 63, 67, 73, 77, 83, respectively. This situation can be explained as follows. When the flat speed is increased, a greater number of flats interact with the fibrous material, leading to a reduction in neps. Furthermore, the increase in flat speeds ensures more interaction with the flat cleaning roller, maintaining flat cleanliness and improving carding efficiency.

REFERENCES

1. PF-60 "On the Development Strategy of New Uzbekistan for 2022-2026". January 10, 2023.
2. Decree of the President of the Republic of Uzbekistan No. PF-5989 "On Urgent Measures to Support the Textile and Garment-Knitting Industry" dated May 5, 2020.
3. Resolution of the President of the Republic of Uzbekistan No. PQ-4453 "On Measures for the Further Development of Light Industry and Stimulation of Finished Products Production" dated September 16, 2019.
4. Decree of the President of the Republic of Uzbekistan No. PF-5285 "On Measures for the Accelerated Development of the Textile and Garment Industry" dated December 14, 2017.
5. Assessment of Cotton Fiber Quality with the HVI 900SA System (Methodological Guide). Tashkent, 2001.
6. Furter, R. USTER AFIS PRO Application Report: Application of single fiber testing systems for process in spinning mills, SE 610, November 2007.
7. Badalov K.I. Spinning of Cotton and Other Textile Fibers // K.I. Badalov, V.V. Zhokhov, N.A. Osmin. - M.: Legprombizdat, 1988. - 448 p.
8. Mirzaboyev J.B., Analysis of fibrous waste generated in carding machines. Development of Science and Technologies. Scientific and Technical Journal. 2024, Issue 3.
9. ASTM D1776:2004. Standard practice for conditioning textiles for testing.