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Design a Process Model to Produce Comb Yarn and Assess Performance of Comb Yarn

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Abstract: *The works reported in this paper outlines the concepts of raw material selection, control of various process parameters in the preparatory processes like blow room, carding, combing preparatory (lap forming), combing, simplex, ring frame and winding to optimize the process conditions, and analysis and interpretation of various types of test reports to find out the source of fault. In order to quality management to do some procedure such as cotton fibreselection , Bale management system, Control of wastes in spinning control of neps , fibre rupture ,control of count, strength and its variation, yarn evenness and imperfection ,short-term irregularity, Interpretation and analysis of diagram, Control of yarn hairiness in spun yarns, yarn faults, productivity of a spinning mill &yarn quality. Therefore, this paper demonstrates the process model to produce comb yarn and assess the comb yarn performance.*

Keywords: *Fiber,Blow room, Carding, Drawing, Combing, Simplex, Ring Frame, Count, Hairiness, Imperfection, Yarn strength.*

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I. Introduction

Spinning is the process of producing yarn from various raw fibre materials. Characteristics of the yarn differ based on the material used, fibre length, alignment, quantity of fibre used and degree of twist [1, 2]. Combing is the process where the noil (short fiber below a predetermined length), fiber hooks, neps and remaining impurities present in carded sliver are removed and Straight and parallel the fibers by drawing to produce uniform and lusture sliver by doubling. As the twist insertion takes place very close to the nip line, short fibers can take up tension. Therefore, the yarn strength is increased as more fibres contribute to the yarn structure [3-9].Process control is an integral part of yarn manufacturing. As the material flow in spinning process is sequential, the output of one machine becomes the input for the next. Each of the machines in a spinning line performs specific and unique tasks. This makes process control critical, as inferior performance by just one machine can spoil the good performance of all the other machines. The key processes leading up to spinning are as follows: The blow room performs opening and cleaning functions. Carding individualizes, parallelizes and cleans the fibre tufts. The draw frame removes irregularities by doubling and drafting, blending, mixing the slivers. Combing primarily removes the fibre shorter than predetermined length, doubling is done here. The speed frame converts the slivers into rovings by imperting slight twist so that they can be used as a suitable feed material for ring spinning. If an analogy is drawn with soccer, then blow room operations and carding form the ‘Defence’ and the ring frame becomes the ‘Forward’ as it spins the yarn as the final outcome of the process. The draw frame, comber and speed frame play the role of ‘Midfield’ as they bridge the activities of the ‘Defence’ and ‘Forward’ operations. The objective of this chapter is to discuss process control activities related to the use of the draw frame, comber and speed frame. Process control is primarily aimed at controlling machine or process parameters such as speed, temperature, humidity, pressure and pH. In contrast, quality control is focused on the measurement and control of product characteristics. Within the spinning process, there is a significant overlap between process control and quality control. The quality of the intermediate and final products is monitored both online and offline, ensuring that any deviation is identified quickly and allowing the swift implementation of process control steps designed to counteract the quality problem. The process control activities related to the use of the draw frame, comber and speed frame are discussed in detail in the following sections.

II. Literature Review

No one knows exactly how old cotton is. Scientists searching caves in Mexico found bits of cotton bolls and pieces of cotton cloth that proved to be at least 7,000 years old [10]. They also found that the cotton itself was much like that grown in America today. In the Indus River Valley in Pakistan, cotton was being grown, spun and woven into cloth 3,000 years BC. At about the same time, natives of Egypt's Nile valley were making and wearing cotton clothing. Arab merchants brought cotton cloth to Europe about 800 A.D. When Columbus discovered America in 1492, he found cotton growing in the Bahama Islands. By 1500, cotton was known generally throughout the world. Cotton seed are believed to have been planted in Florida in 1556 and in Virginia in 1607. By 1616, colonists were growing cotton along the James River in Virginia. Cotton was first spun by machinery in England in 1730. The industrial revolution in England and the invention of the cotton gin in the U.S. paved the way for the important place cotton holds in the world today. Eli Whitney, a native of Massachusetts, secured a patent on the cotton gin in 1793, though patent office records indicate that the first cotton gin may have been built by a machinist named Noah Homes two years before Whitney's patent was filed. The gin, short for engine, could do the work 10 times faster than by hand. The gin made it possible to supply large quantities of cotton fiber to the fast-growing textile industry. Within 10 years, the value of the U.S. cotton crop rose from $150,000 to more than $8 million. Cotton is a soft, fluffy staple fiber that grows on the cotton plants. It grows in a boll around the seeds of the plant. The fiber of cotton is almost pure cellulose. Several civilizations in both the Old and New World stated using cotton for making fabrics, independently of each other. Cotton was used in the Old World from at least 5000BC. Evidence of cotton use has been found at the site of Mehrgarh, on the Kacchi Plain of Balochistan, Pakistan, where early cotton threads have been preserved in copper beads. Some of the oldest cotton bolls were discovered in a cave in Tehuacán Valley, Mexico, and were dated to approximately 3600 BC. Evidence of cotton was also found in Peru in the form of seeds and cordage dating to about 4500 BC. Herodotus mentions Indian cotton in the 5th century BC. Troops of Alexander the Great that invaded India started wearing cotton clothes because they were more comfortable comparing to their woolen ones. In the 8th century the Muslim conquest of Spain brings cotton to the rest of the Europe. During the Middle Ages cotton was a fabric in common use. It was hand-woven on a loom until 1350s when the spinning wheel, introduced to Europe which improved the speed of cotton spinning. When Christopher Columbus explored Bahamas and Cuba, he found natives wearing cotton which probably strengthened his belief that he had landed on the coast of India. During the Renaissance and the Enlightenment cotton becomes highly sought-after in Europe. Vasco da Gama, a Portuguese explorer, opened sea road to Asia, which made caravans obsolete and allowed for heavier cargos. Technology of cotton processing was moving to west. Indian craftsmen protected the secret of how to create colorful patterns but some of them were converted to Christianity and revealed their secret to French Catholic priest, Father Coeurdoux who transferredit to France and planted the seed of European textile industry. Cotton's rise to global importance came through few factors. Some types of cotton fabrics became popular in Europe. Middle class had become more concerned with cleanliness and fashion and needed easily washable and colorful fabric. East India Company introduced cotton to Britain in the 1690s. New inventions in the 1770s—such as the spinning jenny, the water frame, and the spinning formule— and industrial revolution, made the British Midlands into a very profitable manufacturing centre. The workers had poor working conditions: low wages, child labour, and 18-hour work days with whom British cotton products constituted 40.5% of European exports in 1784–1786.American cotton industry starts growing with invention of cotton gin in 1793 by Eli Whitney. By the early 1830s the United States produced the majority of the world's cotton which lead to the expansion of slavery in the United States and by the 1850s slaves made up 50% of the population of the states which produced majority of cotton in US: Georgia, Alabama, Mississippi, and Louisiana. Today industrial production is mostly located in Asian countries like India, Bangladesh, and China and in Latin America. Labor is there much less expensive.

III. Materials, Methods & Design

3.1 Materials

Two types of raw cotton i.e Indian organic raw cotton and Benin raw cotton were used for producing **30Ne combed yarn** in "PAHARTALI TEXTILE & HOSIERY MILLS" Pahartali, Chittagong. **Table–3.1** indicates the cotton fiber properties used in this experiment those were assessed by USTER HVI 1000 and USTER AFIS PRO 2 at standard testing condition [11-20].

Properties	Indian Organic Cotton	Benin Cotton
Length (2.5% span length in mm)	35.7	34.9
Uniformity index (%)	83.1	82.90
Fineness (µg/inch)	4.12	4.41
Strength (GPT)	31.9	32.4
Maturity ratio	0.88	0.88

Properties	Indian Organic Cotton	Benin Cotton
Color Grade	31-1	31-3
Short Fiber Content (%) by Number	26.8	27.0
Immature Fiber Content (%) by Number	6.6	6.1
Neps Count (neps/gm)	107	230
Neps Size (micro meter)	704	708
Seed Coat Neps Count (SCN/gm)	16	29
Seed Coat Nep (micro meter)	908	974
Spinning Consistency Index	144	140
Elongation (%)	3.3	3.6
Trash content	18	14

Table–3.1 Fiber properties of Indian Organic Raw Cotton and Benin Raw Cotton

3.2 Testing of samples

USTER TESTER – 6 was used to determine the unevenness and imperfection (IPI) of the yarn at a speed upto 800 m/min. The observed parameters were U%, CVm%, thin places (-50%), thick places (+50%), neps (+200%) and hairiness. The imperfection (IPI) is the sum of number of mass increase (thick place), mass reduction (thin place) and short mass increase (neps). Tensile properties viz., yarn tenacity, count strength product (CSP) and elongation (%) were measured at Uster Tensojet-4 at a speed of 200 m/min. Average of ten tests were taken for final result at each trial. Lea strength tester was used to find the lea strength tester. Count strength product (CSP) was calculated by multiplying the yarn count with Lea strength according to the British Standard (1985). Equation 1 was used to measure CSP.

CSP = Yarn count × Lea strength

Conditioning time should be at least 48 hours or until their moisture content reaches equilibrium with that of the laboratory atmosphere. All experiments were performed at temperature 27 ± 1°C and relative humidity 65 ± 2%. Yarn imperfection is the summation of thin place, thick place and neps per kilometer of yarn.

Yarn imperfection = Thin places + Thick places + Neps

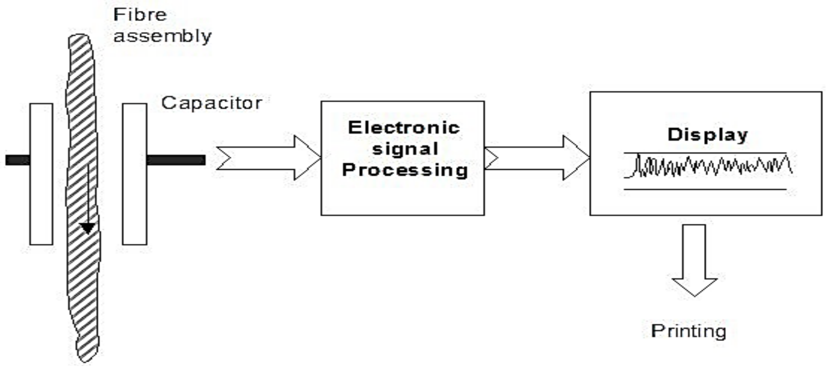


Figure-3.1: Principle of Uster evenness tester [21]

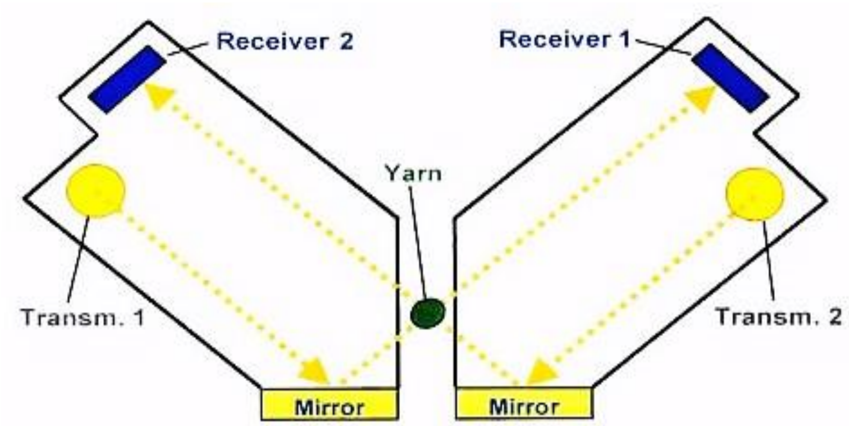


Figure-3.2: Principle of OM sensor of Uster 6

3.3 Bale management

Bale management is the process of testing, mixing, sorting bales according to the characteristics of fibre for producing desired quality of yarn at a minimum range of cost.

Figure-3.3: Cotton bale

Procedure of Bale Management

Bale management process has done by following the below steps:

1. Raw cotton,
2. Moisture percentage testing of bale,
3. Collecting sample from each bale,
4. Texting of sample,
5. Bale classification,
6. Bale law down,
7. Mixing.

Some key properties of bale have to follow before bale management. Those are-

1. Strength,
2. Trash content,
3. Fineness,
4. Maturity,
5. Length,
6. Brightness or whiteness,
7. Uniformity.

Finally, no of 38 bales (27 Benin cotton bales & 11 Indian organic cotton bales) are selected from 5525 bales on the basis of three properties fineness, length, +b value (if increase than yellowness increase). Where Benin cotton average fineness is 4.41, average length is 31.5 mm, average +b value is 9.74 and Indian organic cotton average fineness is 3.96, average length is 31.9 mm, average +b value is 9.46.

3.4 Blow-Room Section

It is a first processing section of cotton yarn manufacturing. The main object of this section are opening, cleaning and mixing of cotton fibre. There are sets of machinery are placed in this section.

Cleaning efficiency of blow room section is 60-70%. If there are 3% trash present in bale cotton then after passing of blow room section, there are only 1.2-0.9% trash present in delivery blow room cotton. Metal, dust and foreign fibre are also separated in this section.

Machine and fibre flow sequence in Blow-Room

Blendomat
↓
SP-EM
↓
CL-P
↓
MX-U
↓
CL-C3
↓
SP-FPO
↓
Carding

All the above operations have explained in the following

a. Opening

Here, the compressed bales of fibres are opened for making the cotton tuft in a small size (as much as possible).

b. Cleaning

This operation is used to remove dust, dirt, broken leafs, broken seeds, stalks and other foreign materials from the fibres.

c. Mixing or blending

Mixing or blending process has performed for producing higher quality yarn by reducing production costing which is only possible by mixing different grade of fibres.

d. Lap forming

This operation has done due to the below reasons:It is done to transfer the opened and cleaned fibres into a sheet form of specific width and uniform unit length which is termed as lap.

3.4.1 Blendomat

It is a bale breaking and opening machine. It traveles at uniform speed from first to last bale of cotton and collect the fibre in small size from bale cotton and supplied to the next machine. This machine takes the fibre material gently and efficiently from bales at micro tufts size and supplies to the next machine from which impurities can be removed very rapidly in the subsequent processes.

Specification

Company Name: Trutzschler
Model No: BO-A 2300
Manufacturing country: Germany
Manufacturing year: 2007
No of machine: 01

Machine Parameter and Performance

1. Input material: Cotton bales
2. No of bales used: 38
3. Functions: Opening (bale breaking), EM.
4. Surface speed: 10m/min
5. Output material: Open fibre
6. Idle time: 5%

3.4.2 Multifunction Separator

The multifunction separator is positioned directly after Blendomat. It is a compact, economical product that helps you save in investment and operating costs. The Multifunction Separator SP-MF combines all relevant protection functions, including initial dust removal.

Specification

Company name	: Trutzschler
Model No.	: SP-MF
Manufacturing country	: Germany
Year of manufacturing	: 2007
No of machine	: 01

Figure-3.4: Multifunction Separator

Technical Data

1. Production: Upto 2000 kg/hr
2. Control system: An intregated micro computer system
3. Material separation: actively and reliably protects cleaners and cards from metal particle
4. Initial dust removal; protects downstream machinery

5. Main parts: Suction, Air separation, Heavy particle separation, Metal separation, Fiber protection, Waste re-feeding.
6. Prepared for installation of individual fire protection devices (spark detectors)
7. Condenser function is done in here.

Machine Parameter and Performance

1. Input material: Opened fibre supply from Blendomat.
2. Function: Condensing, Heavy particle separating, Metal detecting.
3. Output material: Fiber mat
4. Idle time: 5%

3.4.3 Pre-Cleaner

When coarse contaminants need to be removed from raw material, the Pre-Cleaner CL-P is the ideal addition to the blowroom line. Positioned before mixers and fine cleaners, the CL-P Pre-Cleaner ensures that the cotton remains for a longer time in the cleaning roll area and is therefore cleaned intensively, but gently.

Specification

Company Name : Trumac
Model no : MFC
Manufacturing country : India
Manufacturing year : 2007
No of machine :1
No of beater/machine : 2

Machine Parameter and Performance

1. Input material: Cotton fiber mat
2. No of beater: 2 in action
3. Function: Removing coarse contamination, passing fiber for next machine.
4. Output material: Opened fiber
5. Idle time: 5%

andremaining machine processes has been done respectively.

3.5Heat setting or twist setting

Newly manufactured yarn has low moisture content and it has snarling tendency. Heat setting is a process, by which yarn receives sufficient moisture, twist sets in certain place and reduces snarling tendency. Heat setting is done by steam with temperature of 60°c during 50-60 minute with a pressure of 5 kg/cm². At a time 200-300 packages insert in a heat setting chamber for this purpose. Some yarns are heat set by waxing with wax devices; these are used only for knitted fabric manufacturing.

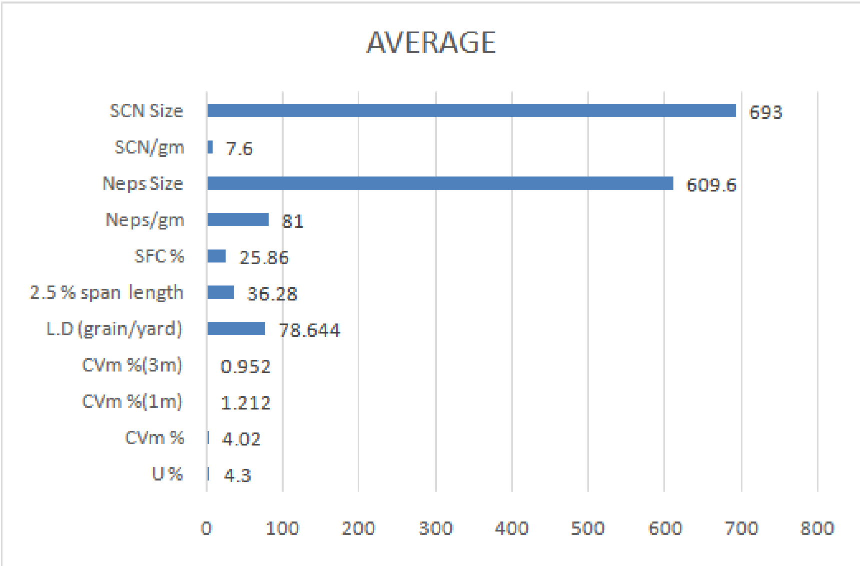
3.6 Packing

Yarn cones are packed in paper cartoons 50 kg for export and 45 kg for local market. Yarn hanks (1lb) are packed 50 kg in sacking for local market for hank

IV. Results & Discussions

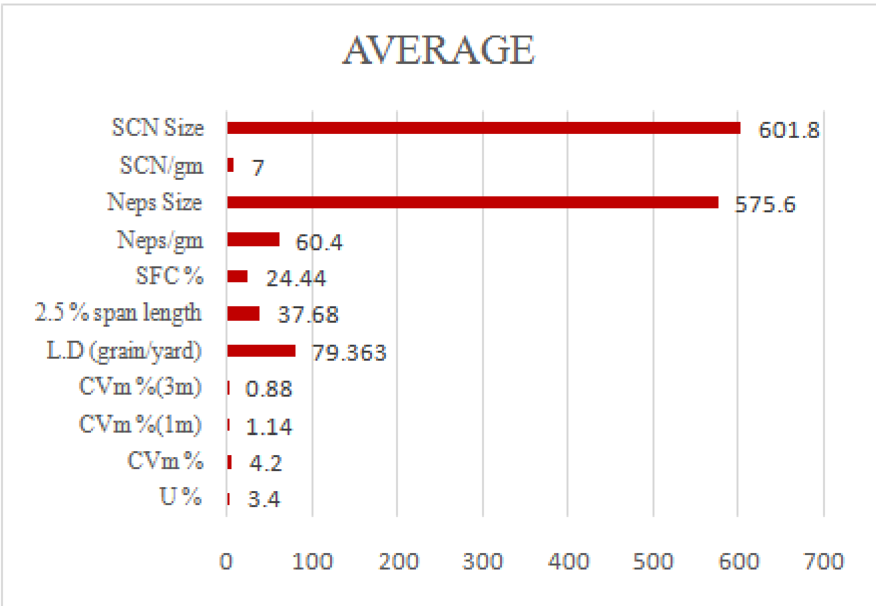
4.1 Quality of carded slivers

Test No.	U%	CVm %	CVm % 1m	CVm % 3m	Linear Density (grain/yard)	2.5% Span Length	SFC %	Neps/gm	Neps Size	SCN/gm	SCN Size
01	3.8	3.6	1.42	0.88	78.001	36.7	25.8	75	608	7	693
02	4.5	4.6	1.29	0.92	79.450	35.9	26.2	90	611	7	705
03	4.2	3.8	0.97	1.21	79.031	36.3	25.5	85	610	9	678
04	4.2	3.9	1.20	0.90	78.888	37	26	75	609	7	688
05	4.1	4.2	1.19	0.85	77.852	35.5	25.8	80	610	8	701
06 Mean	4.1	4.02	1.21	0.95	78.644	36.28	25.8	81	610	8	693



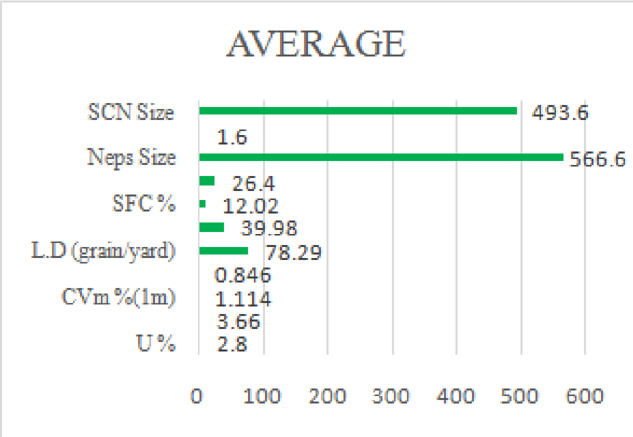
4.2 Quality of Pre-comb Draw Frameslivers

Test No.	U %	CVm %	CVm % 1m	CVm % 3m	Linear Density (grain/yd)	2.5% Span Length	SFC %	Neps/gm	Neps Size	SCN/gm	SCN Size
01	3.0	3.8	0.8	0.6	78.999	37.2	25.8	62	609	4	775
02	3.7	4.6	1.3	1.1	79.272	37.7	23.6	64	554	12	592
03	3.4	4.2	1.1	0.9	80.721	37.3	25.2	54	592	6	525
04	3.5	4.6	1.3	0.8	78.858	38	23.4	60	575	7	542
05	3.4	3.8	1.2	1.0	78.965	38.2	24.2	62	548	6	575
06 Mean	3.4	4.2	1.14	0.88	79.363	37.68	24.4	60.4	576	7	601



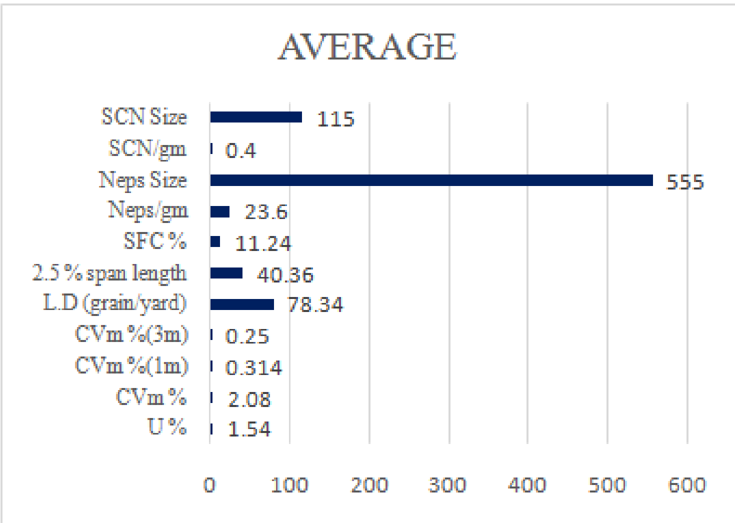
4.3 Quality of Combed slivers

Test No.	U%	CVm %	CVm % 1m	CVm % 3m	Linear Density (grain/yard)	2.5% Span Length	SFC %	Neps/gm	Neps Size	SCN/ gm	SCN Size
01	2.8	3.58	1.07	0.87	78.094	40.0	13.0	27	586	2	632
02	2.9	3.98	1.15	0.89	78.660	39.7	12.1	26	583	1	600
03	2.7	3.42	1.2	0.82	77.731	40.2	11.5	25	588	3	625
04	2.9	3.54	1.1	0.80	78.550	41.0	12.0	26	548	0	0
05	2.7	3.78	1.05	0.85	78.452	39.0	11.5	28	528	2	611
06 Mean	2.8	3.66	1.11	0.84	78.297	39.98	12.0	26.4	567	1.6	494



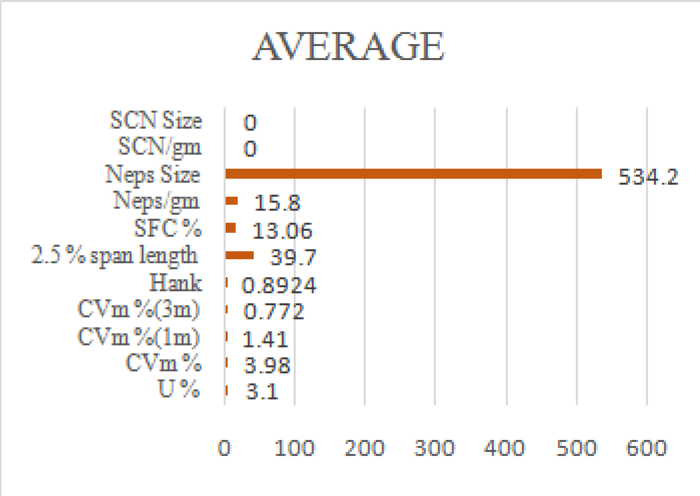
4.4 Quality of Post-comb Draw Frame slivers

Test No.	U%	CVm %	CVm % 1m	CVm % 3m	Linear Density (grain/yard)	2.5% Span Length	SFC %	Neps/gm	Neps Size	SCN/ gm	SCN Size
01	1.6	2.06	0.31	0.21	78.130	40.7	11.5	33	593	0	0
02	1.3	2.08	0.35	0.30	78.290	40.6	12.3	22	534	2	575
03	1.9	2.13	0.27	0.25	78.058	39.7	10.6	22	578	0	0
04	1.5	2.11	0.31	0.22	78.589	41.0	10.8	20	520	0	0
05	1.4	2.05	0.33	0.27	78.658	39.8	11.0	21	550	0	0
06 Mean	1.5	2.08	0.31	0.25	78.345	40.36	11.2	23.6	555	0.4	115



4.5 Quality of Roving's in Simplex

Test No.	U%	CVm %	CVm % 1m	CVm % 3m	Hank	2.5% Span Length	SFC %	Neps/gm	Neps Size	SCN/gm	SCN Size
01	3.0	3.90	1.27	0.61	0.892	39.5	13.8	22	584	0	0
02	3.0	3.89	1.54	0.63	0.903	40.5	13.6	24	642	0	0
03	3.2	4.08	1.40	0.89	0.896	38.2	12.8	10	495	0	0
04	3.1	3.96	1.50	0.88	0.896	41.2	12.5	12	485	0	0
05	3.2	4.08	1.35	0.85	0.875	39.1	12.6	11	465	0	0
06 Mean	3.1	3.98	1.41	0.77	0.892	39.7	13.0	15.8	534	0	0



4.6 Yarn Quality Found in Ring Frame

Test No.	U%	CVm %	Thin -50% /km	Thik +50% /km	Neps +200 /km	IPI	Count (Ne)	E %	TPI	H-Index	Yarn Stre-ngth	Lea Stre-ngth	C.S.P
01	9.8	12.43	0.0	70.0	65	135	29.88	3.4	20.2	5.59	15.49	90.02	2690
02	9.6	12.27	0.0	50.0	120	170	30.05	3.7	20.0	5.50	14.27	92.52	2780
03	9.5	12.07	0.0	10.0	50	60	31.12	3.6	19.9	5.49	15.29	89.88	2797
04	9.5	12.12	0.0	40.0	75	115	30.05	3.4	20.1	5.65	15.50	90.20	2710
05	9.7	12.30	0.0	30.0	65	95	29.78	3.5	20.0	5.41	14.88	91.20	2715
06 Mean	9.6	12.23	0.0	40	75	115	30.17	3.5	20.0	5.52	15.08	90.74	2738

4.6.1 Yarn Unevenness (U%)

Spinning method has significant effect on the yarn evenness. Unevenness is an important statistical tool, for the measurement of evenness properties of spun yarn. The lower the U % value, the more even is the yarn and the more even it will look in the product. **Figure-4.1** shows the unevenness (U%) value of 30Ne combed yarn.

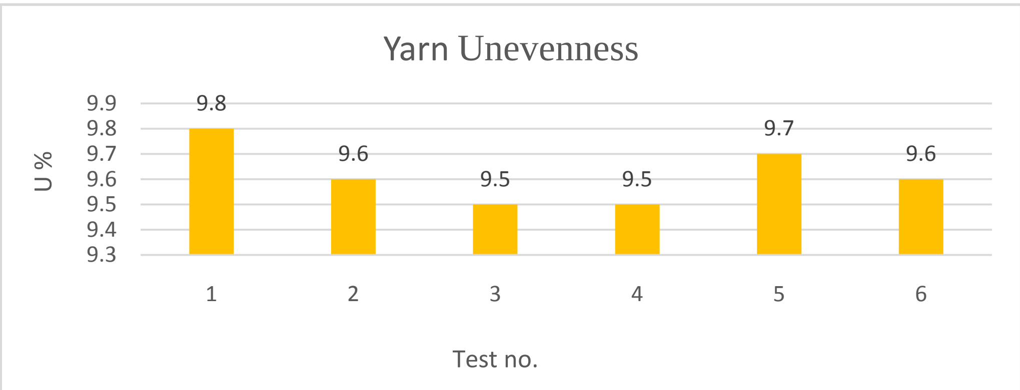


Figure-4.1: Yarn Unevenness (U %)

4.6.2 Yarn Irregularity (CVm %)

The measure of variation of yarn linear density or the variation of its mass per unit length is termed as yarn irregularity [23]. Generally, yarn irregularity points out to the variation of yarn count along its length. Yarn irregularity is denoted by CV which means the co-efficient of variation. It was formed that the higher the CV %, the higher the yarn irregularity is. **Figure-4.2** shows the CVm % value of 30Ne combed yarn.

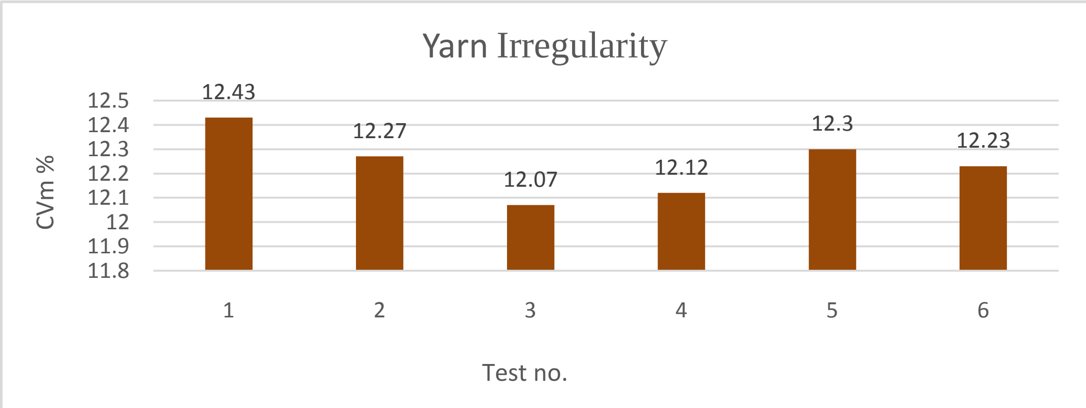


Figure-4.2: Yarn Irregularity

Yarn irregularities and unevenness work as a vital parameter of yarn. Irregularities is mainly caused by improper doubling, drafting, using more short length fiber than their particular length, drafting arrangement, roller, pressuring system etc. In this project using above parameter in processing we were able to get lower level of U % and CVm % value that greatly affect in achieving higher lea strength and C.S.P value of this 30Ne combed yarn.

4.6.3 Yarn Imperfection (IPI)

Yarn imperfection is the summation of thin places (-50%) per kilometer, thick places (+50%) per kilometer, neps (+200%) per kilometer [24]. It is a good indicator of yarn quality that shows how this yarn will perform in the subsequent process such as weaving, knitting, dyeing and printing. Yarn imperfection is mainly caused by improper doubling and drafting, improper drafting arrangement in draw frame, simplex and ring frame, improper pressuring system, faulty T.M and TPI selection, incorrect spacer selection etc. Yarn imperfection is the main fault of yarn that directly affect in yarn strength, lusture properties. In this project we get very lower range of imperfection value which provide greater strength of final yarn and reduce end breakage rate in winding by controlling the process using above parameter. **Figure-4.3** shows the imperfection value of this 30Ne combed yarn.

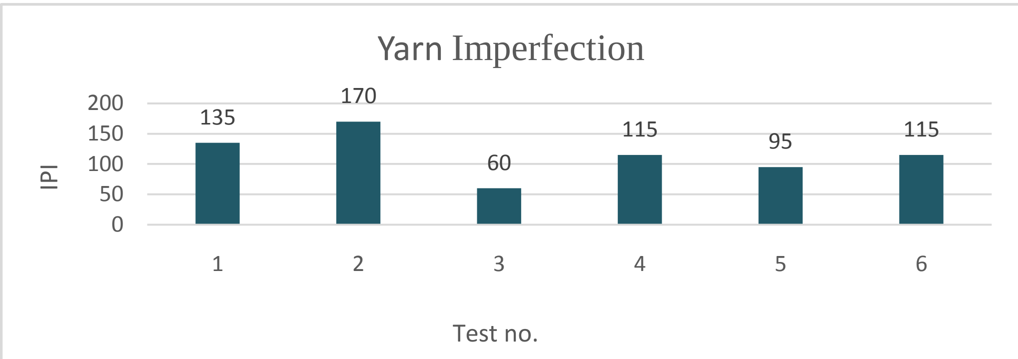


Figure-4.3: Yarn Imperfection (IPI)

4.6.4 Yarn Elongation

Elongation is specified as percentage of the starting length. The elastic elongation is of decisive importance since textile product without elasticity would hardly be useable. They must be able to deform and also return to shape. Higher the value of elongation higher the ability of yarn to return to its previous shape. In this project we used such kind of parameter of different machines involve in manufacturing this 30Ne combed yarn that able us to get suitable value of Elongation (E %).

Figure-4.4 shows the elongation (E %) of this 30Ne combed yarn.

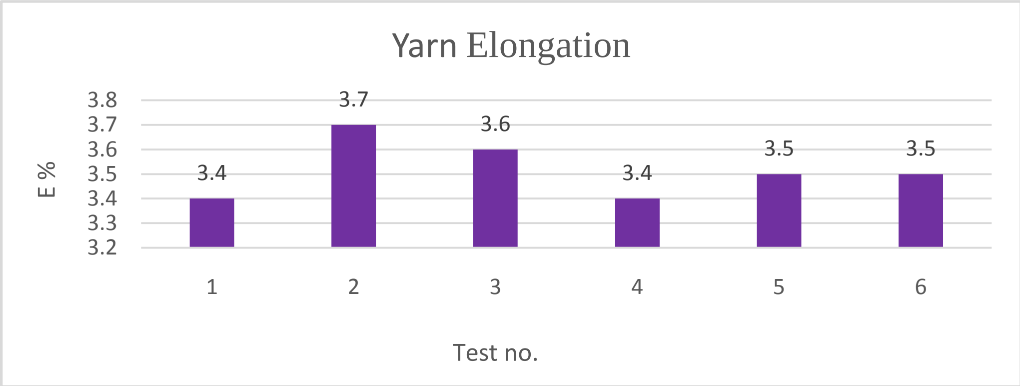


Figure-4.4: Yarn Elongation

4.6.5 Yarn Hairiness

Hairiness means the summation of the length of all projecting fibers in yarn body. One of the important factors for the comfortability of end product, especially apparels is hairiness. Hairiness is mainly caused by using fibers which length is below than particular length or breaking the long fiber in processing (fiber growth). During this project we used comber machine which main object is removing noil (short length fiber) and by removing 18%(approx.) we achieve appropriate hairiness index for this project yarn. **Figure-4.5** shows the hairiness index value of this 30Ne combed yarn.

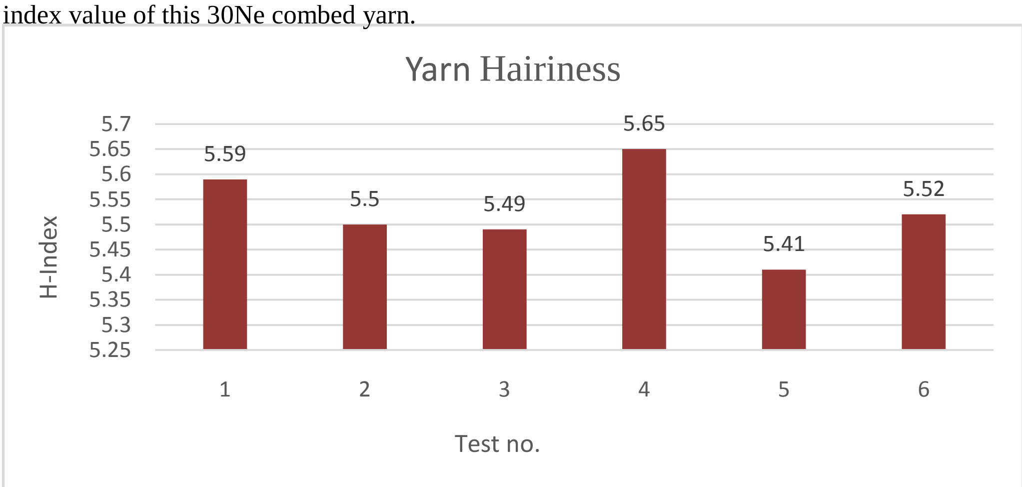
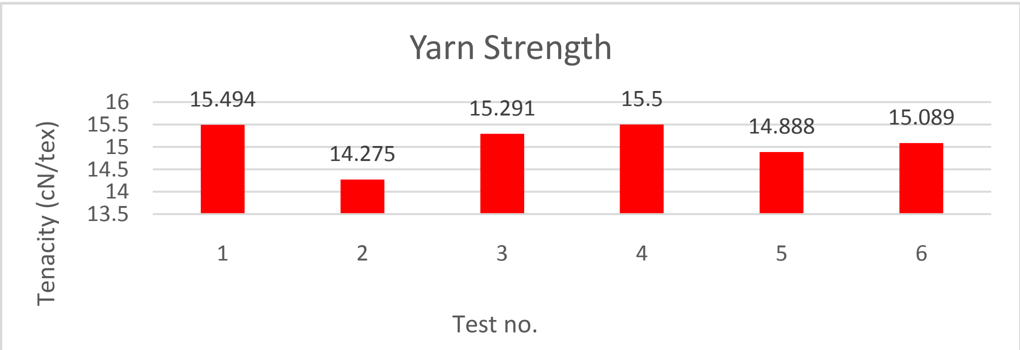


Figure-4.5: Yarn Hairiness

4.6.6 Yarn Strength

Tensile testing of yarns is used to determine the breaking force elongation and toughness, of the yarn. Breaking tenacity, a ratio of the breaking force to yarn. Controlling process by using above parameter we were able to keep imperfection, unevenness, irregularities, hairiness value in range that affect the tensile strength of the yarn. **Figure-4.6** shows the tensile strength (Tenacity cN/tex) value of 30Ne combed yarn.



4.6.7 C. S. P (Count Strength Product)

C.S.P (Count Strength Product) is a number which is derived by multiplication of the yarn lea strength in lbs. and yarn count (cotton count system). The higher the value of C.S.P the better the yarn is. C.S.P is the main parameter that indicates the probable performance of the yarn. The main purpose of all works presenting in this project including raw materials selection, machine arrangement, settings, speed etc for controlling the project is to attain maximum level of C.S.P of this combed yarn. In this project we achieved desired level of C.S.P by ensuring homogeneous mixing and blending, removing neps, noil, dust, foreign particles, selecting proper parameters (draft, speed, pressure, drafting arrangement etc). **Figure-4.7** shows the value of this 30Ne combed yarn.

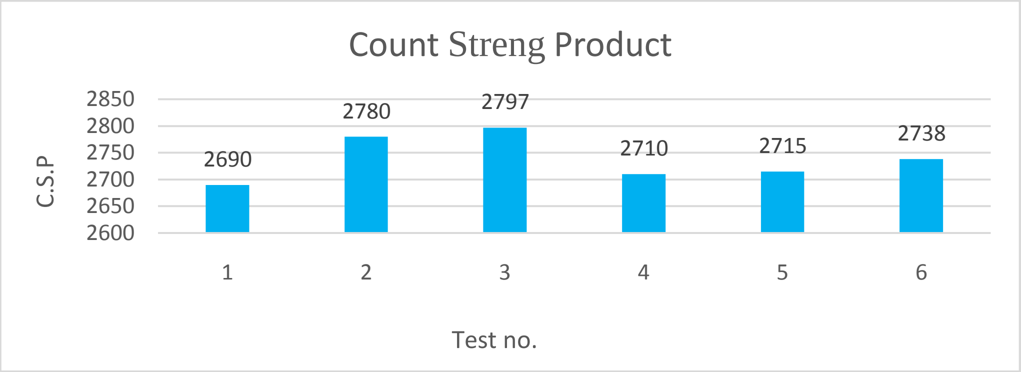


Figure-4.7: C.S.P (Count Strength Product)

V. Conclusion

The properties of ring spun combed yarn were studied in terms of U%, CVm%, total imperfection index (IPI), elongation%, hairiness, tenacity and C.S.P. The overall results showed that using these parameters we got the 30Ne combed yarn with lower U% and CVm%, less Imperfection Index (IPI), lower hairiness, higher tensile strength, higher elongation% and higher Count Strength Product (C.S.P). These studies revealed the consistent results of reduced yarn hairiness, imperfections, irregularities and the ability to produce yarns of enhanced better strength elongation properties even with a less amount of twist, which enables increased production speed to be reached in favor of the ring spun spinning system. Further work could be done on producing quality combed yarn of various counts from all natural, synthetic and blends fibres to justify this analysis. Finally, it is recommended that if it is possible to control the process then the ring spinning will be the best one spinning system to produce better quality of combed yarn.

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