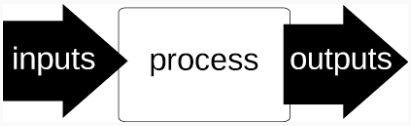
Qualty Control in Spinning

Quality Assurance Steps



- Setting of Norms
- Quality of incoming raw material
- Process Monitoring and Control
- Inspection of final product

Prepared by: ANMA Haque, Assistant Professor, TE

Quality of incoming raw material

- **Test of raw cotton in terms of physical parameters and accept if comparable with norms**
- **Careful transportation & storage of cotton bales**
- **Check sliver or roving parameters i. e. Count and count CV% Trash % & Neps**

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Critical difference(CD)

Critical difference is a measure of the difference between two values that occur due to normal or unavoidable causes.

When the difference between two values exceed that of the critical difference, the two values are said to be statically different.

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CD Tables

Property	No. of tests	Accepted CD%
2.5% spun length	4	4
Uniformity ratio	4	5
Microniare value	4	6
Fibre strength	10	5
Trash content	8	7
Lea count	40	2
Strength	40	4
Single yarn strength	100	2.8
Evenness	5	2.8

$$Calculated\ CD\% = \frac{\sqrt{N_T}}{\sqrt{N_C}} \times CD\%(Table)$$

N_T = Test recommended in the table
N_C = Test actually conducted

Calculation of CD%

Problem-1. A mill wanted to purchase a cotton of 3.7 microns value to spin 50s count. The sample cotton received from a party was tested for micronaire and it was found to be 3.9 (on the basis of 4 test).The mill is interested to know that whether the sample cotton conforms the mills requirements.

Problem-2. Mill C received 5 cotton samples from A & B. Their strength value were found to be 22 g/tex and 24 g/tex respectively (based on 5 tests). Which decision was taken by the mill?

Problem-3. Mill Z received yarn sample from gulshan spinning mill and karim spinning mill. Their strength was found 20 g/tex and 22 g/tex (Based on five tests). Which decision will be taken by the mill?

Calculation of CD%

Problem-1. A mill wanted to purchase a cotton of 3.7 microns value to spin 50s count. The sample cotton received from a party was tested for micronaire and it was found to be 3.9 (on the basis of 4 test).The mill is interested to know that whether the sample cotton conforms the mills requirements.

Solution:

Difference in micronaire values=3.9-3.7=0.2

Difference expressed as a percentage of the specific value $= \frac{0.2}{3.7} \times 100 = 5.4\%$

Critical difference (C.D) for micronaire value as in table =6%

Since the actual difference of 5.4% is lower than the CD of 6, the mills could purchase cotton from whom they received the sample cotton.

Calculation of CD%

Problem-2. Mill C received 5 cotton samples from A & B. Their strength value were found to be 22 g/tex and 24 g/tex respectively (based on 5 tests). Which decision was taken by the mill?

Solution:

The difference in strength between the two cotton (gm/tex)

=24-22=2

Average of the strength value of the two cotton= $\frac{22+24}{2} = 23$

Difference expressed as % of the average of the strength values $= \frac{2}{23} \times 100 = 8.7\%$

The CD for strength is 5% based on 10 tests. But in this case, only 5 tests were carried out to assess fiber strength. Therefore, the new CD using formula-

New CD= $5 \times \frac{\sqrt{10}}{\sqrt{5}} = 7.1$

Since the actual difference of 8.7% is higher than the critical difference of 7.1%, the two samples could be considered as different with regard to their strength value.

Spun length

2.5% spun length: 2.5% spun length is defined as the distance of 2.5% of the fibers extended from the clamp where they are caught at random along their length.

50% spun length: 50% spun length is defined as the distance of 50% of the fibers extended from the clamp where they are caught at random along their length.

Rating of spun length

Class	2.5% spun length
Extra long staple	33.0 and above
Long staple	29.5 to 32.5
Medium staple	25.0 to 29.0
Short staple A	20.5 to 24.5
Short staple B	20.0 and below

Uniformity ratio

Uniformity ratio is defined as the ratio of 50% span length to the 2.5% spun length expressed as a percentage

$$\text{UR} = \frac{50\%\ Span\ Lentgh}{2.5\%\ Span\ Length} \times 100\%$$

This ratio is a measure of the length variability of the cotton. In this case of cotton, this ratio would be less than 50%

Uniformity ratio%	Grade
47	Good
45	Average
43	Poor

Fiber fineness

Fiber fineness affects:

- Strength and irregularity of yarn
- Twist for maximum strength
- Drape and handling of fabric

MIC : fiber weight in micrograms per inch.
It indicates the maturity and fineness of fibers

MIC	Description
3.0-3.6	Very fine
3.7-3.6	Fine
3.7-4.7	Medium
4.8-5.4	Coarse
5.5-above	Very coarse

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Fiber strength

Very weak cotton are to be avoided because cotton rupture during processing both in the blow room and carding causing creation of short fibers and deviation in yarn strength uniformity.

Strength (g/tex)	Description
Less than 21	Very weak
22-24	Weak
25-27	Medium
28-30	Strong
31-higher	Very strong

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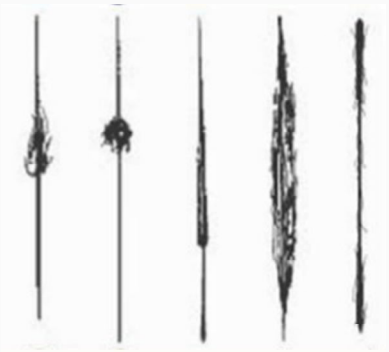
Yarn faults

Spinning in general and even today no possibility is available of ensuing that spun yarn are free of fault.

Common Faults found in yarn are-

- Count variation
- Unevenness & irregularity
- Frequently occurring fault
- Seldom occurring fault
- Hairiness
- Lot mixing



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Count variation and unevenness

Count variation: Practically ± 3 count variation is acceptable. Count can be measured by wrap reel and balance or using count measuring software (CMS).

Unevenness or irregularity: It is the mass variation per unit length. Cut length is taken generally 1cm. Evenness tester is used to measure unevenness.

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Frequently occurring fault

These faults occur in yarn 10-5000 times per 1000m of yarn. Yarn spun from staple fibers contains 'imperfection' which can be subdivided into three groups. These three faults are normally measured in no. of faults per 1 km. These types of faults are determined during evenness testing with imperfection indicator.

Imperfection	X-sectional size	Fault length
Thin place	D-(30 to 60)% of D	4 to 25 mm
Thick place	D+(35 to 100)% of D	4 to 25 mm
Neps	D+(40 to 400)% of D	1 mm

Seldom occurring fault

These faults are referred as yarn fault and characterized in the form of thick and thin places in the yarn which are so seldom-occurring that for their determination at least 1000 km of yarn must be tested.

Fault Name	Thickness	Fault length
Long Thick place	Above +100% of D	Approx. 0.26-8cm
Longer Thick place	Above +45% of D	More than 8cm
Long Thin place	Less -30% of D	More than 0.26 cm

Hairiness & Lot mixing

Hairiness: Hairiness means the protruding fibers on yarn surface. It is the ratio of the total length of hair in any unit to the length observed in same unit. Generally it is measured as the ratio of total length of protruding fibers (in cm) per cm of yarn. The hairiness value is the ratio of two lengths; so it has no unit.

Lot mixing: Sometimes two lots can be mixed at the stage of sliver, roving, bobbin, cone and cartoon in spinning mill, as well as in the preparatory section weaving and knitting mill. This type of mixing causes several problems in subsequent process.

Causes of imperfection

Causes of thick & thin places

Short fiber content

Improper draft

Poor efficiency of carding & combing

Twist variation

Causes of Neps

Immature fiber

Improper ginning

Less efficiency of card

Improper drafting speed

What factors can affect yarn strength?

Quality of Mixing

Fibre Properties:

- Better length, strength & fineness of fibre gives better yarn strength.
- Mixing Ratio: Proper mixing leads to higher & uniform yarn strength.

Quality of carding

- Mechanical condition of all carding surface
- Waste control in carding action
- Proper maintenance

What factors can affect yarn strength?

Quality of comber

- Level of comber waste.
- Mechanical condition of comber.

Quality of drafting at ring frame

- Mechanical condition of the drafting system.
- Total draft.
- Break draft (**break** the mild twist in the roving)

What factors can affect yarn strength?

Quality of twisting at ring frame

Level of twist

Uniformity of twist

Other processing factors

Atmospheric condition

Static electricity

Skills of operator

Fibre Quality Index (FQI)

The different cotton fibre characteristics are synthesized into a single index called fibre quality index.

$$FQI = \frac{LSm}{f}$$

Where, L= 50% span length in mm

S= Fibre bundle strength expressed in gm/tex

m=maturity co-efficient

f= fibre fineness (micronaire value)

Relation between CSP and FQI

$$C.S.P.=320(\sqrt{FQI+1})-13C$$

for carded yarn

$$=320(\sqrt{FQI+1})-13C(1+\frac{W}{100})$$

for combed yarn

Where,

C=Count

W=% waste extracted during combing

Calculation of FQI

Problem-01: A mill spinning 40s carded count achieves a lea CSP of 1950 from a cotton having the following fibre properties-

2.5% span length (l)=28mm
Uniformity ratio (u)=0.47
Micronaire value (f)=4.3
Strength (gm/tex) (s)=22.5
Maturity co-efficient (m) =0.72

How do you rate spinning performance of the mill?

Problem-02: A mill spinning 40s carded count achieves a lea CSP of 2050 from a cotton having the following fibre properties-

2.5% span length (l)=27mm
Uniformity ratio (u)=0.46
Micronaire value (f)=4.3
Strength (gm/tex) (s)=22
Maturity co-efficient (m) =0.75

How do you rate spinning performance of the mill?

Solve Problem 1

FQI = (28*0.47*22.5*0.72)/4.3
= 49.58

CSP = 320* {√(49.58+1}) -13*40
= 320*7.11 – 520
= 2275.2 – 520
= 1755.2

Process Efficiency
= 100%- (Difference of CSPs)*100/Targeted CSP
= 100%- (1950-1755.2)*100/1755.2
= 88.90%

Solve Problem 2

Do!

Fibre testing equipments

HVI (High-Volume Instrument): For fineness, color, trash, length & strength measurement.

AFIS: For neps, size of neps, fibre length, short fibre content, fineness, immature fibre content, no. and size of trash measurement.

Shirley Analyser: For trash content measurement.

Nep counter: For fibre length, neps, short fibre measurement.

Moisture Regain tester: For MR% testing.

Lap, Sliver & Roving testing equipments

Lap length counter

Balance, Scale, Wrap block: For testing sliver & roving testing

Nep counting board

Auto sorter: For sliver count testing

Evenness tester

Yarn testing equipments

Wrap reel and balance: Yarn count testing

Auto sorter: For count & CV% analysis

Evenness tester: yarn imperfection, U%, hairiness etc.

Uster classimate: Yarn fault analysis

Yarn tension meter

Twist tester

Yarn strength tester

Thank You