COTTON FIBRE TESTING

FIBRE ELONGATION: There are three types of elongation

- Permanent elongation: the length which extended during loading did not recover during relaxation
- Elastic elongation:The extensions through which the fibres does return
- Breaking elongation:the maximum extension at which the yarn breaks i.e.permanent and elastic elongation together Elongation is specified as a percentage of the starting length. The elastic elongation is of deceisive importance, since textile products without elasticity would hardly be usable. They must be able to deforme, In order to withstand high loading, but they must also return to shatpe. The greater resistance to crease
  for wool compared to cotton arises, from the difference in their elongation. For cotton it is 6 -10% and for wool it is aroun 25 - 45%. For normal textile goods, higher elongation are neither necessary nor desirable. They make processing in the spinning mill more difficult, especially in drawing operations.

FIBRE RIGIDITY: The Torsional rigidity of a fibre may be defined as the torque or twisting force required to twist 1 cm length of the fibre through 360 degrees and is proportional to the product of the modulus of rigidity and square of the area of cross-section, the constant of proportionality being dependent upon the shape of the cross-section of the fibre. The torsional rigidity of cotton has therefore been found to be very much dependent upon the gravimetric fineness of the fibres. As the rigidity of fibres is sensitive to the relative humidity of the surrounding atmosphere, it is essential that the tests are carried out in a conditional room where the relative humidity is kept constant.
THE SLENDERNESS RATIO: Fibre stiffness plays a significant role mainly when rolling, revolving, twisting movements are involved. A fibre which is too stiff has difficulty adapting to the movements. It is difficult to get bound into the yarn, which results in higher hairiness. Fibres which are not stiff enough have too little springiness. They do not return to shape after deformation. They have no longitudinal resistance. In most cases this leads to formation of neps. Fibre stiffness is dependent upon fibre substance and also upon the relationship between fibre length and fibre fineness. Fibres having the same structure will be stiffer, the shorter they are. The slendernesss ratio can serve as a measure of stiffness,
slender ratio = fibre length /fibre diameter
Since the fibres must wind as they are bound-in during yarn formation in the ring spinning machine, the slenderness ratio also determines to some extent where the fibres will finish up.fine and/or long fibres in the middle coarse and/or short fibres at the yarn periphery.
TRASH CONTENT: In additon to usuable fibres, cotton stock contains foreign matter of various kinds. This foreign material can lead to extreme disturbances during processing. Trash affects yarn and fabric quality. Cottons with two different trash contents should not be mixed together, as it will lead to processing difficulties. Optimising process paramters will be of great difficulty under this situation, therefore it is a must to know the amount of trash and the type of trash before deciding the mixing.
SHIRLEY TRASH ANLAYSER: A popular trash measuring device is the Shirley Analyser, which separates trash and foreign matter from lint by mechanical methods. The result is an expression of trash as a percentage of the combined weight of trash and lint of a sample. This instrument is used

- to give the exact value of waste figures and also the proportion of clean cotton and trash in the material
- to select the proper processing sequence based upon the trash content
- to assess the cleaning efficiency of each machine
- to determine the loss of good fibre in the sequence of opening and cleaning.

Stricter sliver quality requirements led to the gradual evolution of opening and cleaning machinery leading to a situation where blow room and carding machinery were designed to remove exclusively certain specific types of trash particles. This necessitated the segregation of the trash in the cotton sample to different grades determined by their size. This was achieved in the instruments like the Trash Separator and the Micro Dust Trash Analyser which could be considered as modified versions of the Shirley Analyser. The high volume instruments introduced the concept of optical methods of trash measurement which utilised video scanning trash-meters to identify areas darker than normal on a cotton sample surface. Here, the trash content was expressed as the percentage area covered by the trash particles. However in such methods, comparability with the conventional method could not be established in view of the non-uniform distribution of trash in a given cotton sample and the relatively smaller sample size to determine such a parameter. Consequently, it is yet to establish any significant name in the industry.
RAW MATERIAL AS A FACTOR AFFECTING SPINNING: Fineness determines how many fibres are present in the cross-section of a yarn of particular linear density. 30 to 50 fibres are needed minimum to produce a yarn fibre fineness influences

1. spinning limit
2. yarn strength

3. yarn evenness
4. yarn fullness
5. drape of the fabric
6. lustre
7. handle
8. productivity

productivity is influenced by the end breakage rate and twist per inch required in the yarn Immature fibres(unripe fibres) have neither adequate strength nor adequate longitudinal siffness. They therefore lead to the following,

1. loss of yarn strength
2. neppiness
3. high proportion of short fibres
4. varying dyeability
5. processing difficulties at the card and blowroom

Fibre length is one among the most important characteristics. It influnces

1. spinning limit
2. yarn strength
3. handle of the product
4. lustre of the product
5. yarn hairiness
6. productivity

It can be assumed that fibres of under 4 - 5 mm will be lost in processing(as waste and fly). fibres upto about 12 - 15 mm do not contribute to strength but only to fullness of the yarn. But fibres above these lengths produce the other positive characteristics in the yarn. The proportion of short fibres has extremely great influence on the following parameters

1. spinning limit
2. yarn strength
3. handle of the product
4. lustre of the product
5. yarn hairiness .
6. productivity

A large proportion of short fibre leads to strong fly contamination, strain on personnel, on the machines, on the work room and on the air-conditioning, and also to extreme drafting difficulties. A uniform yarn would have the same no of fibres in the cross-section, at all points along it. If the fibres themeselves have variations within themselves, then the yarn will be more irregular.
If 2.5% span length of the fibre increases, the yarn strength also icreases due to the fact that there is a greater contribution by the fibre strength for the yarn strength in the case of longer fibres. Neps are small entanglements or knots of fibres. There are two types of neps. They are 1.fibre neps and 2.seed-coat neps.In general fibre neps predominate, the core of the nep consists of unripe and dead fibres. Thus it is clear that there is a relationship between neppiness and maturity index. Neppiness is also dependent on the fibre fineness, because fine fibres have less longitudinal stiffness than coarser fibres. Nature produces countless fibres, most of which are not usable for textiles because of inadequate strength. The minimum strength for a textile fibre is approximately 6gms/tex (about 6 kn breaking length). Since blending of the fibres into the yarn is achieved mainly by twisting, and can exploit 30 to 70% of the strength of the material, a lower limit of about 3 gms/tex is finally obtained for the yarn strength, which varies linearly with the fibre strength. Low micronaire value of cotton results in higher yarn tenacity.In coarser counts the influence of micronaire to increase yarn tenacity is not as significant as fine count. Fibre strength is moisture dependent. i.e. It depends strongly upon the climatic conditions and upon the time of exposure. Strength of cotton,linen etc. increases with increasing moisture content. The most important property inflencing yarn elongation is fibre elongation.Fibre strength ranks seconds in importance as a contributor to yarn elongation. Fibre fineness influences yarn elongation only after fibre elongation and strength. Other characters such as span length, uniformity ratio, maturity etc, do not contribute significantly to the yarn elongation.Yarn elongation increases with increasing twist. Coarser yarn has higher elongation than finer yarn. Yarn elongation decreases with increasing spinning tension. Yarn elongation is also influenced by traveller weight and high variation in twist insertion. For ring yarns the number of thin places increases, as the trash content and uniformity ratio increased For rotor yarns 50%span length and bundle strength has an influence on thin places. Thick places in ringyarn is mainly affected by 50%span length, trash content and shor fibre content. The following expression helps to obtain the yarn CSP achievable at

optimum twist multiplier with the available fibre properties.
Lea CSP for Karded count = 280 x SQRT(FQI) + 700 - 13C
Lea CSP for combed count = (280 x SQRT(FQI) + 700 - 13C)x(1+W)/100 where,
FQI = LSM/F
L = 50% span length(mm)
S = bundle strength (g/tex)
M = Maturity ratio measured by shirly FMT
F = Fibre fineness (micrograms/inch)
C = yarn count
W = comber waste% Higher FQI values are associated with higher yarn strength in the case of carded counts but in combed count such a relationship is not noticed due to the effect of combing
Higher 2.5 % span length, uniformity ratio, maturity ratio and lower trash content results in lower imperfection. FQI does not show any significant influence on the imperfection. The unevenness of carded hosiery yarn does not show any significant relationships with any of the fibre properties except the micronaire value. As the micronaire value increases, U% also increases. Increase in FQI however shows a reduction in U%. Honey-dew is the best known sticky substance on cotton fibres. This is a secretion of the cotton louse. There are other types of sticky substances also. They are given below.

1. honey dew - secretions
2. fungus and bacteria - decomposition products
3. vegetable substances - sugars from plant juices, leaf nectar, overprodcution of wax,
4. fats, oils - seed oil from ginning
5. pathogens
6. synthetic substances - defoliants, insecticides, fertilizers, oil from harvesting machines

In the great majority of cases, the substance is one of a group of sugars of the most variable composition, primarily but not exclusively, fructose, glucose, saccharose, melezitose, as found, for example on sudan cotton. These saccharides are mostly, but not always, prodced by insects or the plants themselves, depending upon the influence on the plants prior to plucking. Whether or not a fibre will stick depends, not only on the quantity of the sticky coating and it composition, but also on the degree of saturation as a solution. Sugars are broken down by fermentation and by microorganisms during storage of the cotton. This occurs more quickly the higher the moisture content. During spinning of sticky cotton, the R.H.% of the air in the production are should be held as low as possible. **The following table shows the degree of correlation between the various cotton fibre quality characteristics and those of the yarns into which these fibres are spun - RING SPUN YARNS**

	yarn evenness	imperfection and classimat faults	breaking tenacity	breaking elongation	hairiness
fibre length					
micronaire value					
nep, trash, leaf, microdust, fibre fragments					
1/8" breaking strength					
1/8" elongation					
colot/reflectance					

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