(16) Explain the major effects of MR on fibre properties.

(17). What is random sample) its uses

(18)

Module-2

Fibre dimensions - fibre length and Finess.
Importance of these fibres. Measurement by
various methods, principle and instrument. Matu
-rity of cotton fibers and determination. Neps-
causes, and effects of nep genaration. Nep cou
-nting.

Introduction.

An important fibre charcteristic that
influences the process of converting staple
fibre to yarn. That is Spinning is length.
The natural fibres such as cotton, wool
flax etc.... are available only in staple form
; this means that they have limited length.
Especially cotton and wool, are avilable in
good number of varieties. Each oth these
varities. has a characteristic mean length.
Both cotton and wool are therefore classfied
according to their length as long, medium & short

This Section introduces the importance of fibre length in Some detail and then discusses the methods of determining the fibre length used in practice for cotton.

Importance of fiber length.

The fibre length Variable fibers. like cotton or wool is directly related to their spinning performance.

Genarally speaking, the longer varities of fibre give better performance in Spinning as they can be processed more conventrally and efficently. The shorter ones are difficult to process as they cannot easily cohere into a Strand of fibre.

1. In case of cotton: the longer fibers can be spun into finer Counts. this is because the longer cotton fibers are also finer. In the case of wool, the lon-ger fibres are coarse and shorter ones fine.

2. When processing staple fibre, the arrangement of the machinary, the m/c speeds and the setting have to be designed on the basis on each of them length characteristics of the fibre being processed.

3. In yarn production, a greter number of twists per inch are inserted to get maximum yarn strength. The longer the fibers. The greter is the number of two

that can be inserted. long staple fiberes therefore permit the production. of yarns of high strength.

Considering all of the above it is clear that in order to good quality yarn. it is necessary to set and run the machinery with regard to fibre length.

Definition of fibre length and parameter

① **Fibre length.**

This is a genaral term describing the longitudinal dimension of fibre.

② **Staple length**

Staple length' have many definitions, can be found in the literature. two of them given below.

J.E Booth. define. staple length as.

"A quantity estimated by personal judgment by which a sample of fibrous raw material is characterised as regards its technically most important fibre length'

The hand book of textile testing published by Bureau of indian Standards (BIS) defines staple length as follows:

A Measure of fibre length of typical and represen-tative Sample from a bulk

③ Mean length

This is the average length of all the fibres in a sample.

④ Upper quartile length

This is the length is Exceeded by 25% of the fibres

⑤ Effective length

The effective length of a fibre is the length of the main bulk of the longer fibre in the sample.

⑥ Model length

It is the most frequently occuring length of fiber in weight distrubution of the sample.

⑦ percentage of Short fibre

The percentage of fibre that is equal to or less than half effective length.

⑧ Dispersion

This represents the variation in the fibre length

⑨ Span length

Span length is the distance exceeded by a starte percentage of fibers from random catch pointing drafting zone.

2.5% span length

It is defined as the distance spanned by 2.5% of fibers in the speciman being tested when the fiberes are parallelized and randomly distributed and where the initial starting point of the scanning in the test is considered 100%.

50% span length

It is defined as the distance spanned by 50% of fibers in the specimen being tested when the fibers are parallelized and randomly distributed and where the intial starting point of the scanning in the test is considered 100%.

(10) uniformity ratio.

The uniformity ratio is the ratio between 50% span length an 2.5% span length. Expressed as a percentage

$$\text{uniformity ratio} = \frac{50\%\ \text{span length}}{2.5\%\ \text{span length}} \times 100$$

Determination of Fibre length.

The determination of fibre length is of a great importance both for the fiber trade and the textile technologist.

- The following methods of measuring the fibre length have been used.

1. The technician's or the grader method.
2. The breeder's method
3. The technologist's method.

The technologist's methods can be calssified as follows:

a) Direct method
(i) Single-fibre method
(ii) group of fibre method.
Ex: Baer Sorter, Shirley comb sorter.

b) Semi direct method.

c) Indirect method.

1. The technician's / grader's Method

Hand Stapling Method.

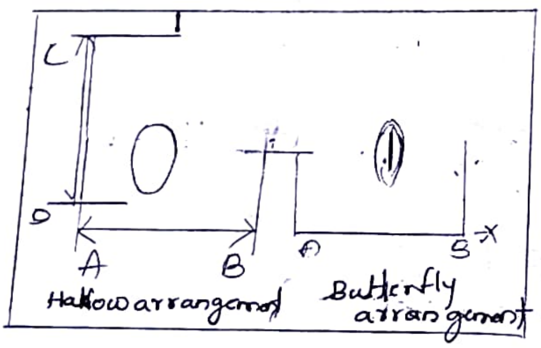
Hand Stapling of cotton is a manual technique of estimating the length characteristics of co-on. This method used by the spinning mill techn-ician for quick assessment of mean. of effective length of Sample from bale of cotton.

The hand Stapling methods are,

- Selecting a sample and preparing the fibers by hand doubling and drawing to give firaly well straightend tuft of about ½" wide

- This is laid on flat black background, Staple length is measured.
- The Sorter fiber will lie on body of the tuft and Extreme ends (tips) will not be limits for measurement of staple length.
- The classer chooses the length where the are reasonably well defined edges.
- Subjective in nature, So difference in results between classers.

2. Breeder's Method



This method is used in cotton field where the cotton is avilable in the form of seed cotton (KAPAS). To arrive at a meaningful value of the length of the cotton in this form the following method are adopted.

a) The fibers attached to each seed are gentally pulled out in the radial direction without damaging the fiber. Such that they from uniform halo around the Seed.

41

The fibers are thus speed out as a flat layer ar-
-ound the seed.

b) place the prepared halo on sheet of paper which two lines intresecting at right angles are drawn. The centre of seed. should co-incide with the point of interaction of two lines, as. as shown in figure. using a ruler the points are noted as, OA, OB, OC and OD. the sample is then flipped over and similar measurement are made on the other. side of halo too.

c) The mean length is the average. length of the fibre in all directions, considering values on both the front and reverse sides of the halo in each case. The mean length halo often called "halo length"

c) The halo length is then determined. for another 20 seeds selected randomly from the bulk and the mean of the values. is reported as the mean length of the fibre. Sample.

Alternatively. the fibers are parted at the tip. and the root of the seed and spread out in two opposite directions. OA and OB. the average length mea-sured thus. is called the butterfly method: or "butterfly length"

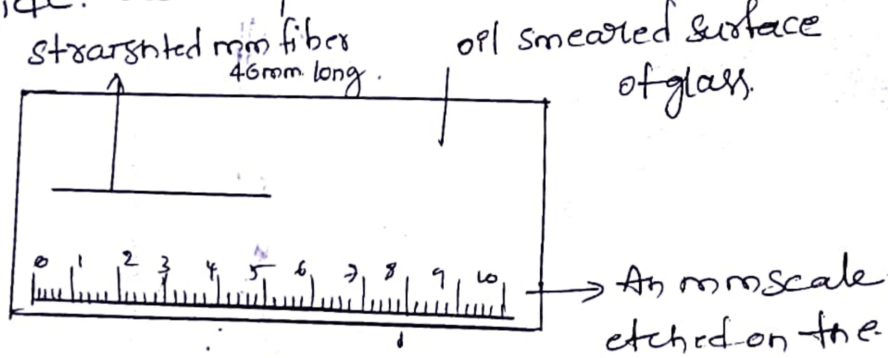
> holo method gives a more respesentative values but incase butterfly method gives a apporximat values.

3. Technologist's Method

ⓐ Single fibre tests

(i) oiled-plate-Method

This method is usdd for cotton and short man made staple fibre. this method uses. sheet of glass.. which has a cm scaled etched. under side. as depicted in figure,



The Surface of glass is smeared with liquid paraffin. A thin layer of some 20 to 25 fiber from the sample is placed on the plate. Then, with the tips of the little fingers of each hand, the fibers are straightened one at a time over the scale and smoothed out stright and their length are noted. The praffin servers to keep the fibers from blowing about and assists in making them lie flat and straight

Serves to keep the fibers from blowing about and assists in making them lie flat and straight on the scale when brought into position. With practice, and patience upto 300 fibers per hour may be measured in their way, so a test may be completed 2-2½ hours.

(i) Velvet-pad and forceps method

* This method is used for measuring wool and madefibers of comparable length.
* A purely manual procedure
* A black velvet covered board is used instead of the oiled plate.
* A pair of forceps or sometimes pairs are used to hold the fibers at their extreme tips.
* The pile in the fabric helps to keep the fiber being measured straight.
* Same of the oil plated method.

(b) Group of fibers method

(i) Baer Sorter

It is a comb sorter instrument which enables the sample to fractionalised into small length groups.

Principle

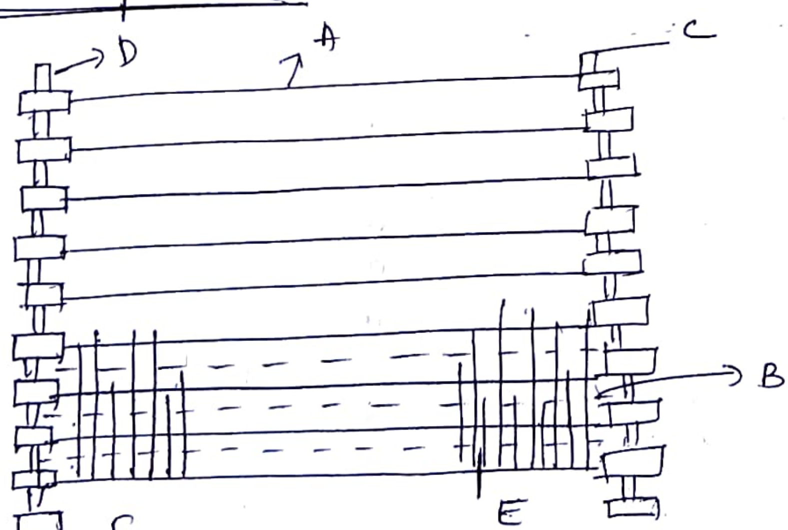
A numerical sample of fibers is arranged in the form of an array in the descending order of length and from a tracing of this array the effective length, mean, % of short fibers and dispersion are calculated.

Steps

Mainly 4 steps,

1) preparation of tuft will all the fibers
2) Withdrawal of fibers in the order of decreasing length
3) preparation of Sorter diagram by laying the fibers on a black velvet pad.
4) Analysis of diagram.

Description



- A - Bottom combs.
- B - position of top combs
- C - Hinged support
- D - sliding pin
- E - fibre fringe
- F - Black velvet pad.

The Bear Sorter consist of bed of combs which control and enable the sample of fibers to be fractionalised into length groups. The Bear Sorter has 12 combs are hinged A/b placed in between a 'D' shaped metallic frame. All the bottom combs are hinged at one end and are supported by a rod. Extending the width of the frame at the other hand the rod can be moved from its position and when it is drawn the combs can be dropped one by one. the tops combs when placed in between the two bottom combs. the distance between them will be 1.8 inch.

Manipulation of the fibers is done by a grip called tweezer a depressor and a blunt needle.

Procedure

The position of fiber unit in the istrument Shown in figure. A repersentative sample of cotton is made into Sliver by drawing and doubling several times with the fibers Strengthend and parallellised The bundle of fibers must be as narrow as possible through out the whole process. The method of sorting as follows.

1) The Sorter is placed with the back facing the operator the prepared sample is Slightly

twisted and placed on the bottom combs, at the right hand side of sorter with a small tuft protroduting.

2) From protroduting end, all those fiber removed from the forceps. The removed loose fibers are kept separately and introduced in original sample later

3) A tuft of fibers are pulled out, combed and transfered to a left hand side of the sorter. so that the comb nearest to the operator. from the starting line for the tuft,

4) The process is repeated till all the fibers on the righ hand side all combings are transform to the left side

5.) The top combs are inserted in their position to grip and to control the slippage of the fibers.

6. The sorter is then turned round so that the front face the operator.

7. The bottom combs are dropped one by one successively till the tip of the longest fibers are seen.

8) The fibers are pulled by the tweezer, combed straighted and laid in to the base line on a black velvet pad. After the pattern is built up. a transperent scale with one side of the rectangle

marked
1/4" is pl
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1)
2)
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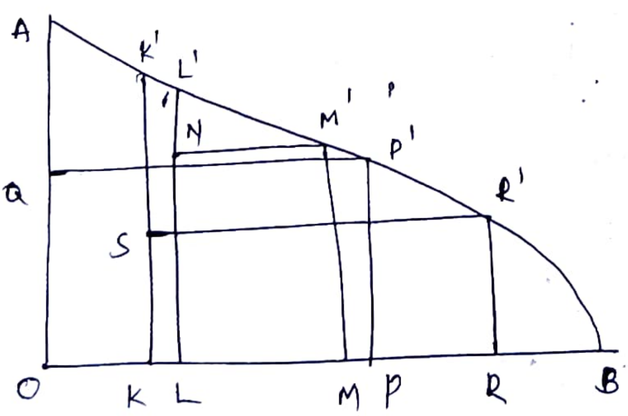
marked with 1/8" lines and the other side marked wi... 1/4" is placed over the pattern.. reading on a transpara...nt scale, the values of the co-ordinators are marked on graph sheet and the pattern is drawn. this is diagram called "Sorter diagram". This diagram is analysed for the following parameter

1) effective length
2) Mean length
3) Modal length
4) % of short fiber.
5) Dispersion

Analysis of Sorter diagram

The statistical analysis of sorter diagram requires a construction called Miss clegg's construction. The analysis is done as follows



$OQ = \frac{1}{2} OA$

$OK = \frac{1}{4} OP$

$OL = 1/4\ OR$

$OM = 3/4\ OR$

Effective length = LL'

% short fibre = $\frac{RB}{OB} \times 100$

% Dispersion = $\frac{NL'}{LL'} \times 100$

Mean length = $\frac{\text{Area of OAB}}{OB}$

From figure

1. Q is the mid point of OA, i.e $OQ' = \frac{1}{2}OA$
2. From Q. QPI is draw parallel to OB to cut the curve at p'
3. PP' is draw ⊥'r to OB.
4. OK is marked on OB. So that OK' = 1/4 OP and ⊥'r line KK' is drawn
5. S is the mid point of KK'
6. From. S. SR' is drawn parallel to OB to cut the curve at R'
7. From R' a ⊥'r line RR' is drawn.
8. OL is marked on OB, So that OL = 1/4 OR.
9. From L a ⊥'r line LL' is drawn to cut the curve at L'

(b) <u>The Shirley comb Sorter</u>

The Shirley comb sorter was developed by Shirely development Ltd. Manchester. England UK. This sorter is quite similar to baer sorter. The essential difference is that it consist of 9 bottom combs and 8 top combs, the bottom combs are set 1/4 inch apart except the 1st two bottom combs, which are 3/16 inch apart.

The distance from a row of bottom needles to a row of top needles is 1/8 inch. the procedure for the determination of fiber length characteristics is the same as the baer sorter.

(c) Fibrograph

It is an optical instrument employing photo cells for scanning samples of parallel fibers & tracing a type of length frequency curve.

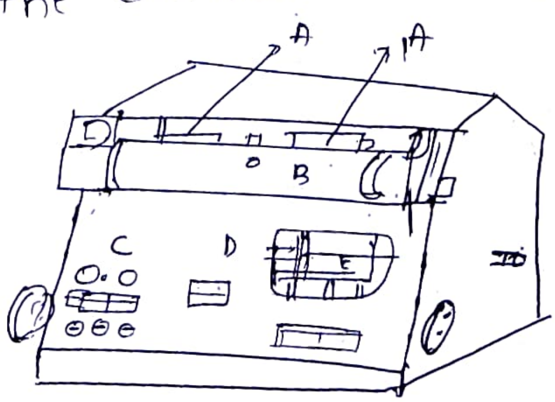
Types of fibrograph instrument

There are two types

1) Conventional
2) Digital.

Conventional fibrograph

K. L Hertel developed this instrument in 1940. It worked on photoelectric scanning principle while the single fiber method considers only major of fiber namely the length. the comb sorter technique cons... the area of the cumulative frequency diagram.



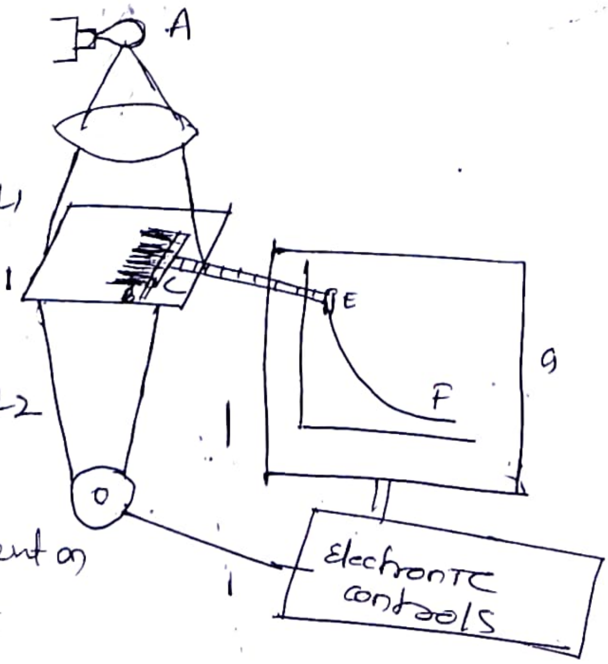
A - 2 special combs hold the fiber
B - flurocent lamp house
C - control knobs & swi...
D - fibro scan unit
E - lenses

The photoelecteric Scanning principle.

The fibrograph instrument uses an optical device to scan the test sample. the optical devices passes a narrow beam of fluroscent light through two moving frings or beards of fiber. Depending upon the density of fiber frings and the number and length of the fiber in each of them, a part of light passes through the fibre and this is collected and sensed by diodes. Electric controls the circuit in the instrument analyse the input from the diode and convey it to a fibrogram unit that displays the output in the form of length-frequency curve reffered to as a fibrogram.

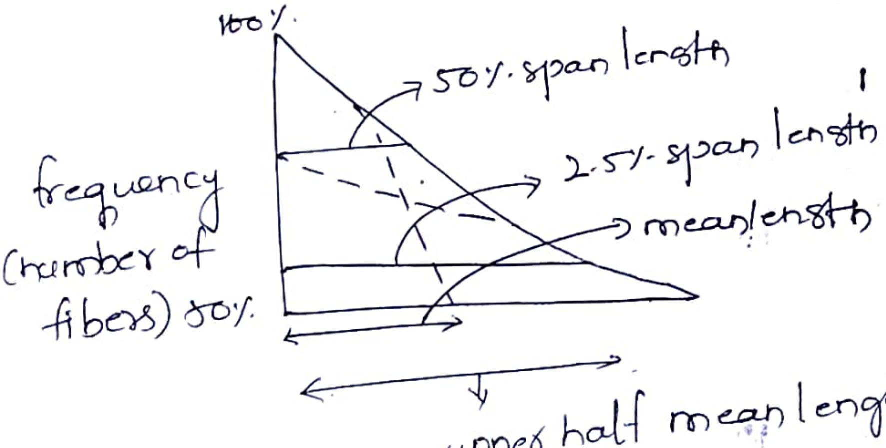
The curve is analysed to provide a measure of the following three length characteristics of sample.

a) Mean length. b) upper half mean length c) uniformity ratio



A - light source
B - slit
C - sample
D - photoeletriccell
E - Recording pen
F - Fibrogram
g - paper card
L1 - light beam incident on fibre fringe
L2 - Emerging light

A diagram of the instrument it self is Shown figure. The two fibre fringes. used in instrument are prepared manually using two special combs and and elaborate process across the narrow beam of light for the scan is also done manually. The final output of the instrument is a graph, namely the length-frequency curve or the fibrogram is analysed manually. The accuracy of the results thus depends on operator efficiency



Above figure shows typical length frequency curve given by this instrument. The horizontal axis represents the lengths of the fibers in the sample beard. The vertical axis represents the percentage of fibers that have a length equal to greater than any given length in the X-axis. The construction to arrive at the mean length and upper half mean length in simple. A tangent to the upper part of curve cuts the x axis to give mean length and a tangent to the lower part of curves cut the x-axis to give the upper half mean length. The ratio of the former to the latter Expressed as a %. gives a uniformity ratio.

The fibrogram can also measure the 50% and 2.5% span length.

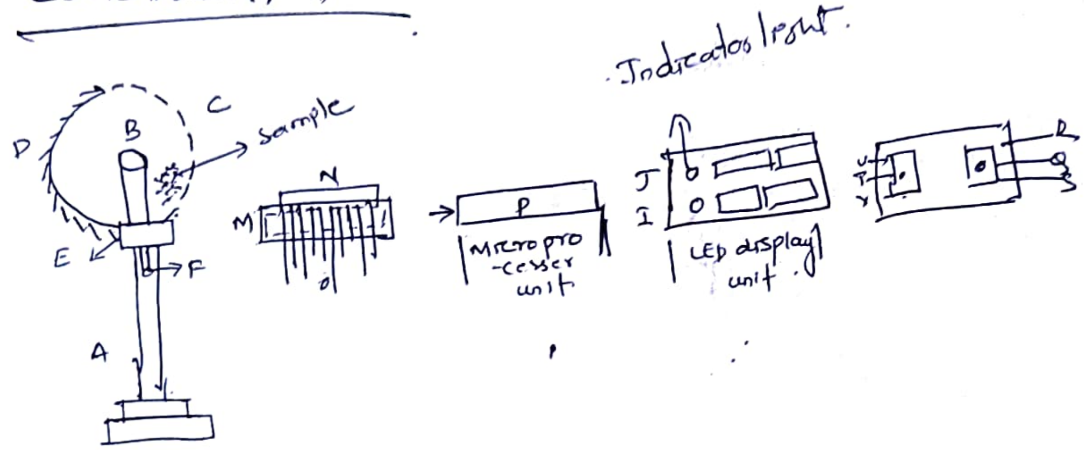
Digital Fibrograph

This is the much improved and automated version of conventional instrument.
The digital fibrograph comes with special device called "fibro-sampler" that the operator uses, to prepare the beards or fringes of cotton on special combs that are smaller and more compact than one used earlier.

The instrument gives the following information for a test sample of cotton.

- 2.5% span length
- 50% span length
- uniformity ratio
- short fibre index
- Amount of fiber.

Construction



Fibre sampler.

The major parts,

1. fibro sampler
2. LED display
3. Microprocesser unit.

fibro sampler

B → cylinder
B → perforatted steel plate.
D – wireclothing

A comb holder E and handle F are also provided. this cylinder fixed by cj.

LED display unit: The LED display unit consist of zero adjustment knob, and indicator light J and four digital display screens K. The four screens display respectively the 2.5% span length, 50% span length, uniformity ratio, the no.% of short fiber.

Microproccer unit

This unit is built into the instrument. Besides the microprocesser unit the instrument also consist of a comb sorter. an optical unit L and a photo electro dear, sensor M.

test procedure

The door of the comb holder of the instrument is open and the comb holding the fibre specimen is inserted into the comb holder. The push button at the back of the instrument is set to its lower most position ie to select the test mode. The door is then closed. The comb holder automatically moves back and fourth once and then returns to its original position.

The scanning results are then instantly displayed on display screen at the 2.5% span length. 50% span length. uniformity ratio and number of fibers. The push button at the back, left of the instrument is now pushed to its middle position to get a reading of short fibre index at the place where the uniformity ratio was displayed.

Fibre fineness

Fineness.

Fineness denotes the size of cross-sectional dimensions of the fibers.

Importance of fineness

- Fineness is one of the most important fibre characteristics.
- The fineness determines how many fibers are present in the cross-section of yarn of given thickness. Additional fiber in the cross-section provide not only additional strength, but also a better distrubution in the yarn.
- Thirty fibers are needed at the minimum in the yarn cross-section, but there are usually over 100.

Fibre fineness influence primarily

→ spinning limit
→ yarn strength
→ yarn evenness
→ yarn fullness
→ lusture
→ handle
→ productivity.

Methods of Measuring fibre fineness

The following methods are used to measure the fineness of cotton fibers.

(a) Gravimetric method
(b) optical method
(c) Vibroscope method (d) Airflow method

(a) Gravimetric method

This method is suitable for both natural and man made fibers.

(a) gravimetric method, (cotton)

- From comb sorter diagram, fibre tuft are taken and at spacing of 1cm tuft sections are sliced out with the help of razor.
- 100 fibers are counted and weighted on a sensitive micro balance.
- convert into mass / length

(2) Gravimetric method (wool)

- wool has almost circular cross-section
- After completing fibre length test the fibers are collected and throughly cleared of oil allowed to condition and micro balance.
- The total fibre length is calculated and knowing the number of fibers weight length is derived.

Mean wt / unit length = $w / \Sigma hn$

where, h - the class length

n - number of fibers

w - total wt of classes.

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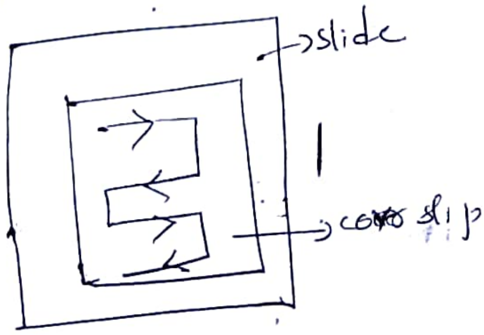
(b) optical method

the optical method can be used both for fibers of regular and irregular cross-sections.

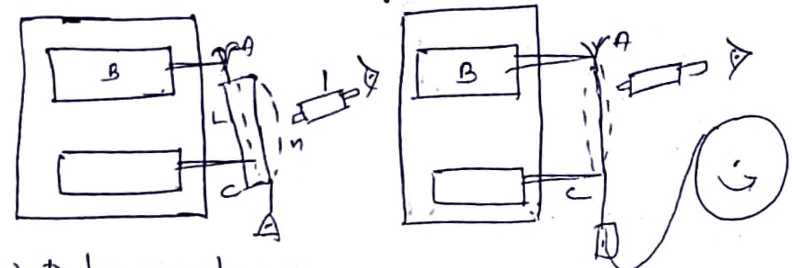
Fibers of circular cross Sections: For fibers of circular cross-sections. such as the regular synthetic fibers nylon, polyester, polypropylene etc.

- Applicable to the fibre with circular cross-Sections.
- A Suitable random & representative sample is conditioned for 24 hours in standard testing atmosphere
- Fibers are cut into Suitable small length & slide is prepared by carefulley mixing the fibers into mountant.



- The mounting agent should be non swelling and have a suitable refractive index.
- The mixture of fibers and mount is spread thinly one the slide and covered with cover glass.
- The slide is traversed in Zigzag fashion, to cover the all fibers randomly.

(C) Vibroscope



(a) Determination M by varying F and keeping T constant

(b) Determining M by varying T and F constant

A - clamp
B - Vibrater
C - Knief edge
D - Drum
E - clip
G - chain
n - Vibrating fibre
l - low powered microscope
L - length
M - constant tension

This is an instrument that indirectly measurs the linear density of fibers with irregular cross sections but in the variability is not as excessively high in which the cotton.

The Vibroscope is based on the principle of flexible vibrating strings. The reader will be aware of the basic working principle of stringed musical instruments such as the guitar violin sitar etc).

If a fibre of length L and linear density M is held at tension T. it can be caused to vibrate in transverse direction at different frequency of vibration

$$F = \frac{1}{2L}\sqrt{T/M}$$

$$\therefore M = T/(2LF)^2$$

Thus if L, T and f are known M can be calculated.

The Experiment and the apparatus are so de-signed that two way of determing M are possible

① Tension T can be kept constant & the frequency F cand be varied to find one that produce the maximum amplitude of Vibration.

② The frequency f can be kept constant and T can be varied till one is found that produces the maximum amplitude of Vibration.

fig ⓐ the fiber is clamped at A. It is Vibrated and varying fixed frequencies by vibrator B. The other end of the fibre passes over a knief-edge cand is weighted appropriately to give a constant tension M. in the fibre, the length of fiber from the clamp A to the kniet edge is L. the resonant frequency of Vibration of test specimen is noted as that frequency which causes the maximum amplitude this is determined by observing the middle portion of vibrating fibre by means of a lower power microscope. thus knowing L, F and T, M can be calculated using relation.

Fig ⓑ Shows an essentially Simillar arrangement
Except that the Vibrator applies a Vibration
of fixed frequency Speciman. the tension in the
Speciman is Varied by the chainomatic arrange
-ment shown at the right. In this Setup the free
end of the uniform flexible chain is attached
to the lower end of speciman. in other end
is connected to a drum D that can be rotated
either way to have any required length of
chain hanging freely under test speciman.
The tension required to cause resonance
in the speiman. is note and M can be computed

(d) <u>Airflow</u>

The following are the instrument working
on air flow principle used to measure the
finences of cotton fibers.

ⓐ Sheffield micronaire
ⓑ ATIRA fineness tester
ⓒ Arealometer.

The dimenstions Varies from one Variety
to another, one crop to another, one plant
to another plant Also, there is Variability.

within a given boll of fibre. To get a reliable result.

principle of airflow

A sample know weight is compressed in a cylinder to known volume and subjected to an air current at known pressure. the rate of air flow through this porous plug of fibre is measured. The rate of air flow is measured measured by a flow meter calibrated in terms of units of fineness.

Micronaire

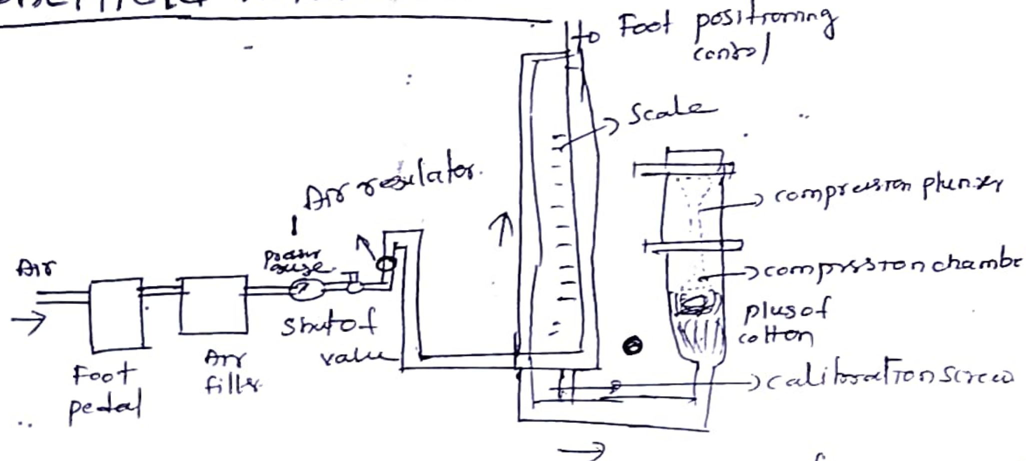
Micronaire is the name used originally for an instrument manufactured by Sheffield co-orporation of USA. The instrument is based on the air flow principle.

Micronaire value is a measure of the specific surface area of cotton fibers It is determined by measuring the resistance offered by a mass of fibers compressed to a fixed volume to the flow of air at fixed pressure.

principle

The rate of air flow is inversely proportional to the Surface area of the fibres. A sample of Know weight is compressed in a cylinder to known Volume and subjected to an air current at known pressure. The rate of air flow through this porous plug of fibres, related to the fineness of cotton fiber is measured.

Sheffield micronaire



A Schematic diagram shown in figure, air from a compresser is supplied to this instrument to allow the air into instrument the fool pedal is pressed the air pressure is noted on the pressure gauge. To filter the dust particles an air filter. is incorporated in the line. the inlet air pressure to the fiber can be altered using the air regulator. this air is divided into two streams at the point X, one stream passes through the flow meter to atomosphere. The another steam passed through the perforation through the fibre in fibre chamber and through the hole of the plunger to the atmosphere.

the air regulator controls the air pressure difference across the plug of fibre. reducing the input pressure of over 40 lb/sq. inch to 4.75 lb/sq.

Initial Setting

1. The pressure of air supplied to instrument is adjusted to 1.75 kg/sq.cm (25 PSI) by adjusting the primary air regulator.

2. the pressure of the air fed to the fibre is adjusted to 0.42 kg/sq.cm (6 psi) of mercury using the manometer and air regulator.

3. The special master plug is pushed home into the fibre compression chamber.

testing procedure

1) 50 grains of sample is taken weighing the precision balance only ±0.1 grain (6 milligram) is permitted as tolerance.

2. The sample is opened very well into tuft and all the knotty balls and stringly sections are taken out and the fibers are separated and randomised individually.

3. The sample is introduced into a compression chamber.

4. The fiber compression plunger is inserted and locked in its place by twisting. the compress the sample into a porous plug of fiber. of 1" diameter and 1" length

5. The foot pedal is operated to allow air inside and the reading is taken with the top level of the float.

6. The foot pedal is operated to shut off the air flow, then fibre sample is removed from the compression chamber by operating the foot pedal

7. The specimen is opend out and repacked into the fiber compression chamber and the above procedure is repeated.

8. Two samples should be tested from each test lot and the avg. value is calculated to the nearest 0.1 micronaire unit.

ATIRA Fineness

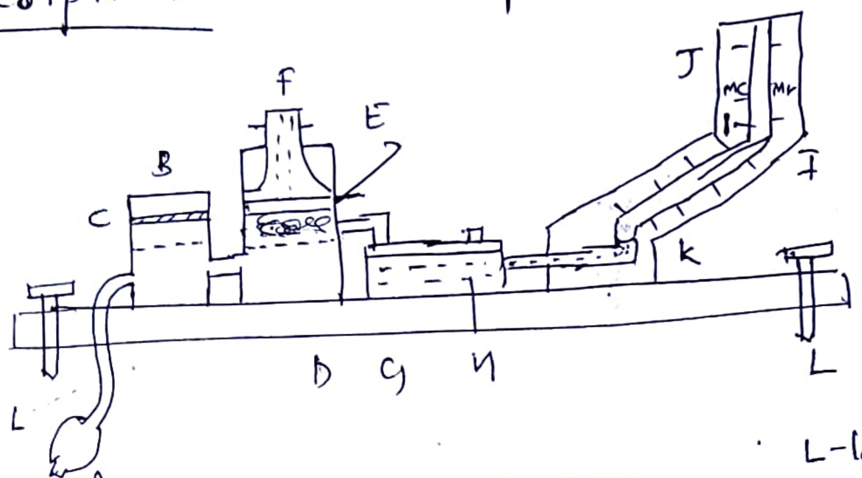
This instrument is developed by Ahmedabad textile industry's Research Association (Atira) and. it measure. the micronaire value and mc and maturity fineness.. Mu of cotton have separate two scale. Mc value is the micronaire value. Mu is a product of maturity and fineness. in microgms/inch.

Principle

* It is working on air flow principle
* A sample of known weight is compressed in a cylinder to known volume and subjected to an air current at known pressure.

* The rate of air flow through the porous plug of fibers which is related to the fineness of the fibre is measure

Description



L-levelling screw.

A - Aspirator bulb
B - Air tank
C - Float
D - fibre chamber.
G - Reservoir
H - Monometric liquid
I - Flow meter
J - Top mark
K - Bottom mark.

The instrument consist of flowmeter, two scales are graduated at the sides of flow meter in terms of Mc & Mr and reading indicated by monometric liquid. the monometric liquid is provided in a reservoir. air can be supplied to the reservoir at constant pressure. by means of float inside an air tank by squeezing an aspirator bulb.

The cotton fibrechamber is provided b/w the air tank and reservoir ~~bulb~~. so air can pass through fibers. the fibers can be looked by means of plunger. in which small holes are provided.

levelling screw is adjust the instrument. ~~and~~.

Initial Setting

1. keep the instrument on a rigid horizantal table

2. Accurately level the base of instrument with the three levelling screws provided and using sprit level
3. check the liquid level in monometer.
4. Squeeze the aspirator bulb so that the float in the air tank. rises to the top.

procedure

1. weigh out 4gms of given cotton sample
2. place the cotton sample with small pieace sample at a time in the cotton chamber. insert the plunger and lock it in its place
3. gently squeeze the aspirator bulb. so that the float in the air tank to the top
4. wait for the float to decend and the monometer level to become steady. Read the scale value of Mc & Mn corrsponding to this level.
5. open the chamber take out the sample. fluff is out. reload and repeat.
6. The mean of two readings.. Mc & Mn calculated.

points to be considered

* sample is free from dust
* the test itself on given sample can be done on to sub samples of 5gms and with two tests per subsample, Then base upon micronaire valus, The sample can be graded before

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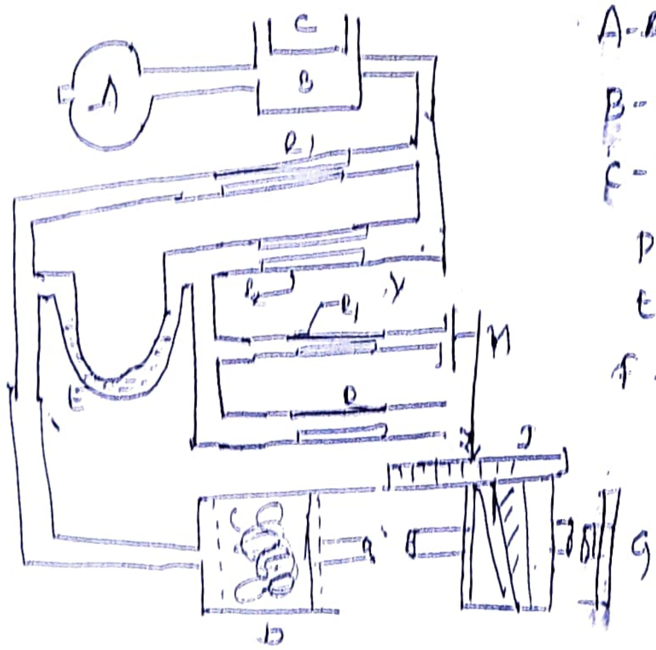
Arealometer

This is an instrument based on the air flow but different in construction from the micronaire. The principle here that at Null air flow. this instrument find out both. Maturity and fineness.

Principle

The resistance to air flow is fixed and to find. by experiment the length.l. to which plug of fibers must be compressed in order that it shall also have the same resistance.

Description



R1 R2 - Resister of equal resista
R, R' - standard resistors.
A - Aspirator bulb.
B - Air tank
C - Float
D - fibre chamber.
E - monometer
F - High compression scale
G - Micrometer screw
H - pointer
I - low compression scale
V - Value

- The air circuit in Arealometer as shown in figure
- Air at a constant pressure is supplied to the instrument by repeatedly squeezing an aspirator bulb connected to pressure tank. containing loosely. fitted weighted ~~cotton~~ piston

* This floating piston permits air to escape at constant pressure
* Air leaving the cylinder is divided into two steams along resistor R_1 and R_2 of equal resistance
* The air stam entering R_1 passes throus the fibers in the fibre chambe to th atmosphere.
* The air stream entering R_1 pass through two other narrow standard resistor R and R_1 connected in parallel to the atmosphere. When the value is opened.
* The fibre chamber is perforated. to permit unrestricted entry of air from R_1
* A liquid monometer is connected across any pressure difference between the air entering the fibre chamber. and that entering the resister R and R'

The instrument is portable of measure the parameter such as specific surface area fibre weight and immaturity ratio. A small sample of 152 mg is used the istrument is similar to the wheatstone bridge in which three resistance of the resistance consist of copper capillairs and the fourth is the fibre plug under test

immaturity ratio $= I = \sqrt{0.07\ D + 1}$

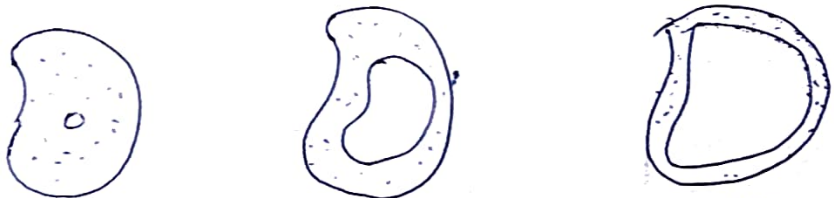
Fineness, in mg / inch (H) = 485000 ($1A^2$)

Fibre Maturity

Fibre maturity is another important characteristic of cotton. It is an index of extent of development of cotton fibers.

It well know that during the growth of cotton plant and the development of fibre in the bolls, the soil and the environment must be condunciye to healty growth of the fibre.

If some reasons one or another condition is not satisfactory there is a marked variation in morpholog of fibers. The development of secondary cell way of the fibre most affected if the growth conditions deteriorate somewhere in between the developmental period. In such an event, the fibre maturity is greatly affected and in severse instances, the cotton may be unfit to spin into yarn.



(a) Mature (b) Half mature (c) Immature

Above figure shows the cross-sectional apperance of developed, and underdeveloped cotton fibers. It may be seen clearly that a mature fibers has a thick well or wall thickening as it sometimes reffered. The lumen corresponding is small. On the other hand partially developed or half mature fibre the cell wall is thinner and the lumen is wider. In a immature fibre, there is little evidence of wall thickening and the fibre is like a flabby tube with very lar... lum...

Improtance of cotton fibre maturity

cotton fibre maturity grealty affects nep formation, dye uptake and dyed apperance variations in maturity within a yarn batch or fabric can lead to streakiness and barri because of difference in dyed apperance it is however, not only the average maturity which is important but also the distrubution of maturity

Methods used to Determine the materity

The following method have been comman used for determining the maturity of cotton.

1) Direct method - caustic Soda method
2) Indireet method.
   - ⓐ polarised light method
   - ⓑ causticaire method
   - ⓒ Differntial dyeing tehnique

1. Direct Method - caustic Soda Swelling method

It is most commonly used method. A thin tuft of fiber is drawn by means of tweezers from sliver held in comb sorter.

There are two steps involved in this method.

1. Treatment with 18% caustic soda.
2. Examination under a microscope to count the mature, half mature and immature fibers.

principle

A parallel bunch of cotton fibers is mounted in mercerisation concentration caustic soda solution of on a microscopic glass slide and viewed under microscope. The number of mature and immature fibre are then counted and the degree of maturity of sample.

In view of mercerising action of caustic soda and the consequent deconvolution or removal of convolution in the fibers and the final counting of the mature fibers the results of the test has also frequently been reffered to as the "deconvoultion count"

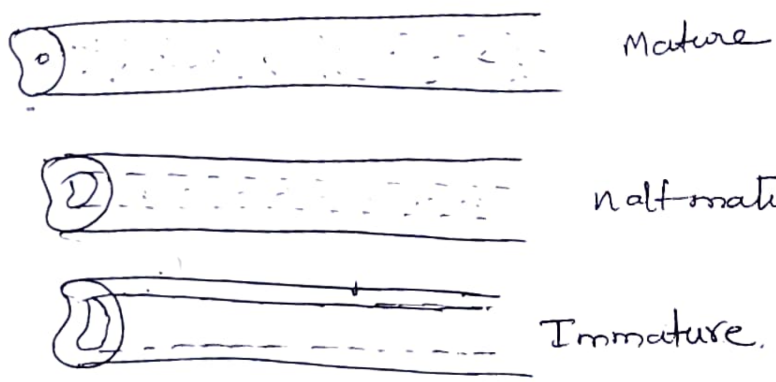
procedure

A thin tuft of fibers is drawn by means of a pair of tweezers from a hand made sliver that has been gently pressed into the combs of a comb sorter. the fibers in the tuft are combed so they are nearly parallel to each other. they are then laid on a microscope glass slide. the fibers are covered by means of a cover slip placed over their middle portion. Four to 8 such slides are prepared.

Next, the fibers on the microscope slide are irrigated with one or two drops of 18% caustic soda solution the fiber swell in the solution. The slide is then placed on the stage of microscope and examined at a magnification of around 3000 A projection microscope is more convenient as it would make the observation less strenous the. into the 3 groups as listed below,

① mature or normal fibers
② half-mature or thin walled fibers
③ Immature. or dead fibers.

The presence of caustic soda. changes the apperence of both mature. and immature fibers. by swelling



All the prepared slides of fibers are examined thus under the microscope and the fibre maturity count on the % of mature (N), half mature (H) and immature (I) fibers are calculated.

The maturity of sample of cotton is then expressed in terms of any of the following maturity parameter :

① % of mature of fibers (N)
② Maturity ratio (M)
③ co-efficient of maturity (Mc)

% of mature fibers (N)

Knowing the total number of fibers examined and the total number of mature fibers, the % of the mature half mature and dead fibers can be calculated using formula.

(i) % of mature fibers = $\frac{\text{Number of mature fibers}}{\text{total number of fibers examined}} \times 100$.

Maturity ratio

This is a term that considers the % of the normal and dead fibers are and express the maturity as a single index i.e maturity ratio, denoted by M

$$M = \frac{N-D}{200} + 0.7$$

where, N - % of Normal fibers.
D - % of dead fibers.

co-efficient of maturity or Maturity count

$$M_c = \frac{N + 0.6H + 0.4I}{100}$$

where N - % of mature fibers
h - % of half mature fibers
I - % of immature fibers

The % of the mature, half mature and immature fibers in a sample denote the fibre maturity count or maturity coefficient.

II. Indirect method

In the indirect methods. Some property of the cotton fibers which is dependent on maturity is made use of for estimating maturity.

① Defferential dyeing method

Mature and immature fibers differ in their behaviour towards various dyes. Certain dyes are preferentially taken up by the mature fibers and some dyes are preferentially absorbed by the immature fibers. the difference between the dyeing property of mature and immature fibers is employed to give a visual indication of maturity of a sample of cotton.

~~In this method.~~

Causticaire method

this method is based on the flow of air through a plug of cotton fibers, the resistance offered by the plug of cotton is dependent not only on the fineness of the fiber but also on the mature of the fiber.

In this method, the micronaire instrument, with a special scale called the causticaire scale, is used. two sample of weight 50 grains are taken and tested on the instrument and the avg causticaire reading is noted.

Neps.

A nep can be defined as small knot of entangle-ment fibers consisting either. entirely of fibers.

Causes

Almost any mechanical process can cause the formation of neps but the most likely once include harvesting, ginning, and opening / cleaning in the textile mill.. Neps are generally removed from the cotton fibers at only two places in textile mill i.e. the carding m/c & the combing m/c.

effects of Nep generation

mostly caused by processing. Background related to neps in cotton and the problems associ-ated with them have been considered in the Section of cotton fibre maturity

Neps in cotton have to be contended with right from the field stage through the spinning process.

Nep counting

The nep count can be calculated as.

$$\frac{\text{Number of neps per } 100\, in^2}{} = \frac{n \times 100 \times \text{hank of sliver} \times \text{width of card in's}}{0.12 \times 40}$$

Nep count can be defined as.

The number of neps 100 square inch of card web that would be required to give a sliver of standard hank of 0.12 on a carding m/c. 40 inchs widee.