Evaluation of Textile Materials
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Lecture– 12
Evaluation of Fibre Fineness

Hello everyone, so we will continue with the course, Evaluation of Textile Materials. In last session we have started the measurement of characteristic of textile material. We have started with the one of the most important characteristic of Staple Fibre that is the length. There we have discussed various length related parameters, and uniform uniformity parameters and also we have discussed various methods of measurements.

And now we will discuss another important parameter, of textile material, textile fibre, this characteristic is that it is "Fibre Fineness". So in most of the material the fineness, like cylindrical material, the fineness can be easily expressed by diameter. So, in that case, fibre, for fibre, also it should be, actually the diameter should be, one of the parameters, we should be able to measure the diameter.

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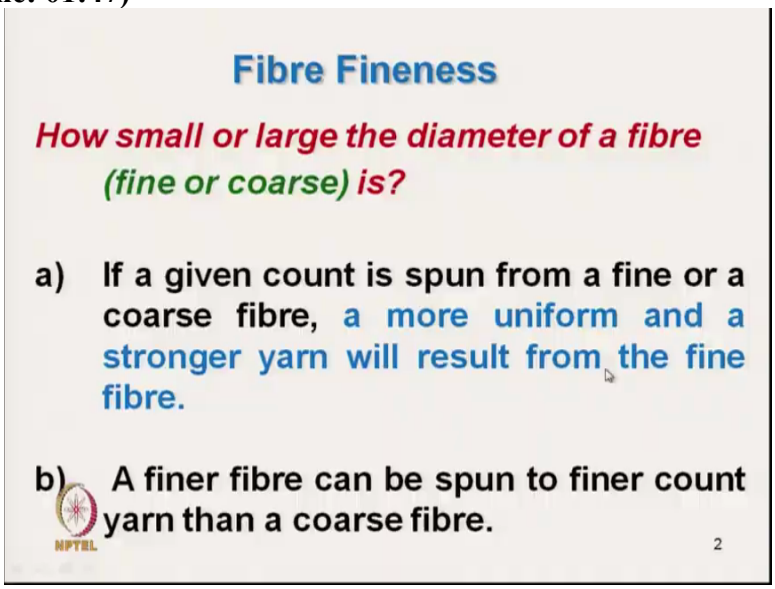

So fineness means that, how small are or large the diameter of a fibre is? So we would like to know the finer or coarser whether the fibre is fine or coarse, so we would like to know by measuring the fineness. But fineness we know that itself basically cross sectional shape. If a fibre is fine, the cross sectional area should be less. But most of the textile material, textile fibre, the main problem is that, that it is a basically it is not uniform. Now, by knowing the fibre fineness, so, we would like to know the various actually process related parameters.

So if a given count is spun from a fine or coarse fibre, so more uniformity we will get, high uniformity, and stronger yarn we will get from the finer fibre. Because in case of finer fibre, so for same yarn linear density, if we use finer fibre, that means, the number of fibres in the cross section will be high. So, higher number of fibre in the cross section will result the higher uniformity.

And also higher number of fibre will have more and more contact points, higher contact points that will result, for the same fibre strength, is getting same, fibre density keeping same, but we use fibres in smaller diameter, that will result higher contact area and we have stronger yarn.

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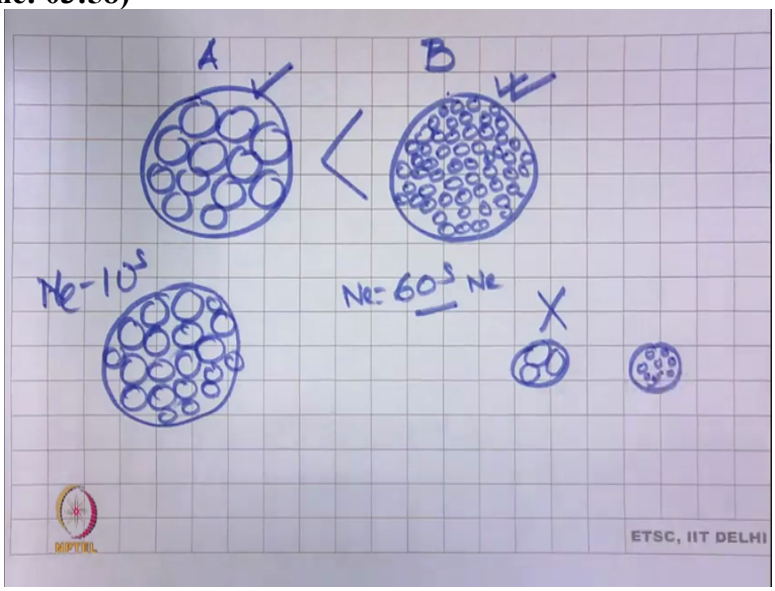

Like we can see here the two yarns, this is one yarn, and two yarns are there. Yarn A and yarn B. So the yarn count of the two yarns are exactly same, but yarn A we are preparing, making the yarn A by using coarser fibre, so the number of fibres in the cross section will be less. But yarn B we are using finer fibre, so this is the number of fibre. So the number of fibre will be very high. So if we use the smaller fibre, finer fibre with smaller diameter.

So here yarn B the number of fibres are more, so the uniformity of yarn is actually and will be very high that is evenness, the CV percent will be low. Because it is a inversely proportional to the number of fibres, as the number of fibres increases, the CV will reduce. Also if we see, if we compare yarn A and yarn B, as the number of fibres are more, so higher contact area, contact area between fibre to fibres are there.

So an in yarn A, as coarser fibres are there, contact area between fibres, fibre to fibre contact area, will be much less than in case of B. So the between fibre contact area if it increases, that means frictional contact will increase, so as we know the staple fibre, yarn, strength comes

only by friction. So if this A and B are from same staple fibre, of different diameter fibres, so yarn A as it has got less contact area, for keeping all other parameters same, yarn A will result lower strength.

So this yarn B will have higher strength and lower irregularity that is higher uniformity will be there. So it is obvious that now so that quicker, by using finer fibre, we can achieve the stronger yarn and uniform yarn. So it is very important to know the diameter of fibre ok. Finer fibre can be spun to finer yarn count, ok than coarser fibre because for finer for yarn to be manufactured to be actually produced, we need minimum number of fibre in the processor. So, if finer yarns are to produced, in that case, we have to use finer fibre. Again we can come here,

You can see this is yarn, you have to, this is a certain count of yarn, ok suppose this is yarn is say, English count, 10's, English count, we are using one particular fibre, ok, so that is working here because, number of fibres are, required fibres are there, it is coarser count, ok. Now suppose we want to produce finer count, 60's count, 60 inner's, so 60's count yarn we want to produce, and yarn is, the yarn diameter is this one.

Here if we want to use the same fibre, so number of fibre will be very less. So yarn we cannot form, yarn if at all the yarn is formed, yarn will highly irregular and strength will be very less. So to produce finer yarn, so if we want to produce finer yarn, then we have to use the very fine fibre. So by using finer fibre, we can produce finer yarn, and getting very good quality. So, the finer yarn can be produced from finer fibre.

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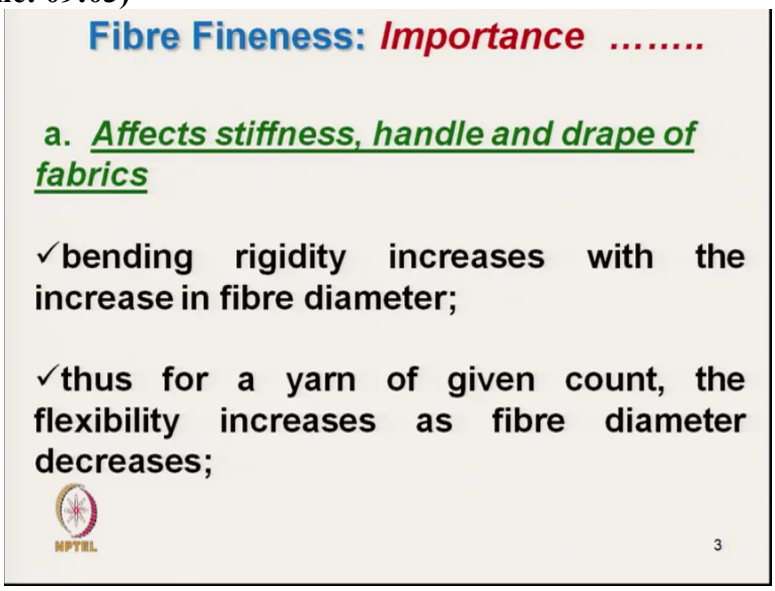

The fineness affects, now we will see the; what are the; what is the importance of fineness of fibre, and what are its affect, effect on different characteristics. So, it affect various

characteristics, first is the, it affects the stiffness, handle and drape of fabric. So the bending rigidity of fibre increases with the diameter ok, as the fibre diameter increases, its bending rigidity will increase.

So, the bending rigidity of fabric or its stiffness will also increase, and it affects the drape characteristics. So to have very soft fabric, very soft handle, highly drappable fabric, we must use a minor fibre, ok. Thus, for a yarn of given count, the flexibility increases as the fibre diameter decreases. So if we use the coarser fibre, the stiffness of the yarn will increase.

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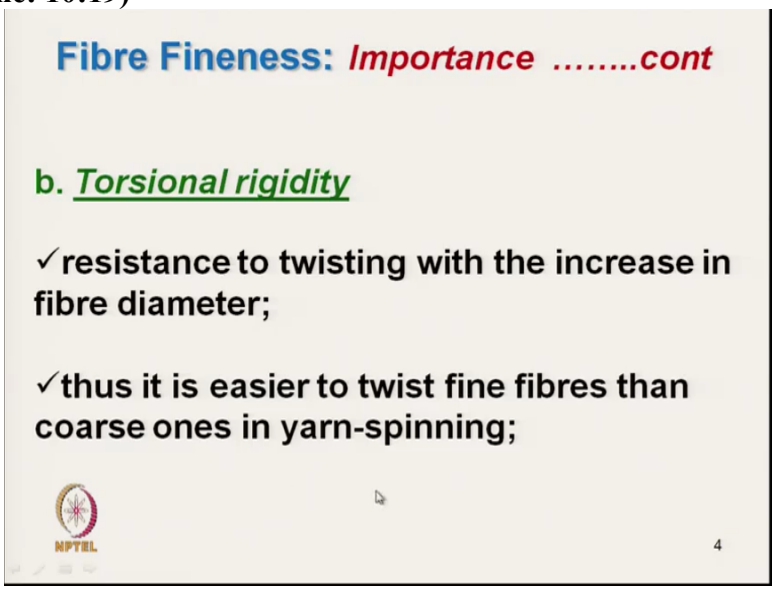

Now coming to the Torsionol rigidity; so torsionol rigidity increases with the increase in fibre diameter ok, the resistance to twist with the increase, is the increase in the diameter of fibre. That means, if we want to produce yarn, with any coarse fibre, so, that means the fibre due to its torsionol rigidity and high bending rigidity that will not actually follow, the helix of the yard, ok.

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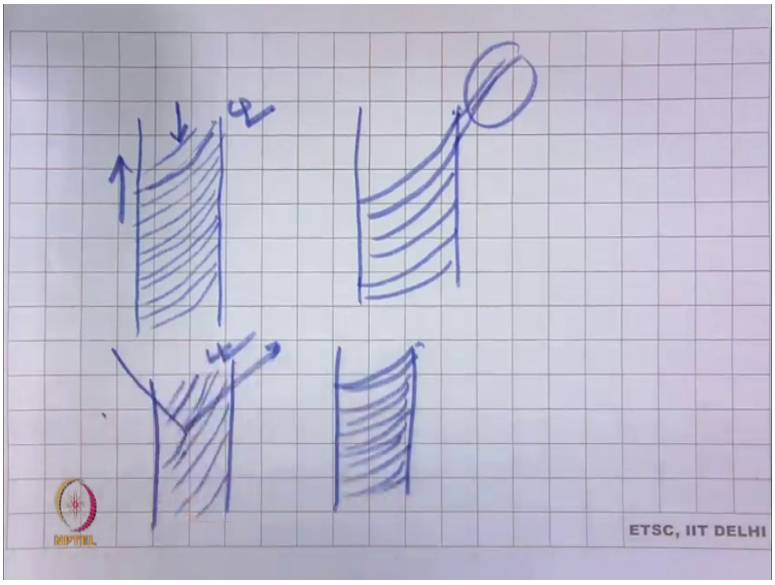

Now let us see what happens if we use the coarser fibre. If we use the coarser fibre, what happens, this is yard, we want to twist, ok, now if we use the finer fibre, finer fibre, when we apply twist, that will follow the helix, and also it will follow the migration area, whatever heavy during the twist. But, if we want to twist the coarser fibre, coarser fibre, due to its high torsionol rigidity, it will not be twisted easily, so, that it will not follow the helix also, that this fibre will come out from the structure, surface structure.

So that will result here, ok. So, for coarser fibre, from coarser fibre it is very difficult to twist, so for spinning, staple fibre spinning, we have to go for the finer fibre ok. So, twisting is a problem. Thus it is easier to twist finer fibres than coarser ones in yarn spinning. So therefore if it is a given option, two fibres are there, that is of keeping all other parameters same. The fibre with lower diameter we must always select, for spinning because the spinability of that fibre with lower diameter is much better than the coarser fibre.

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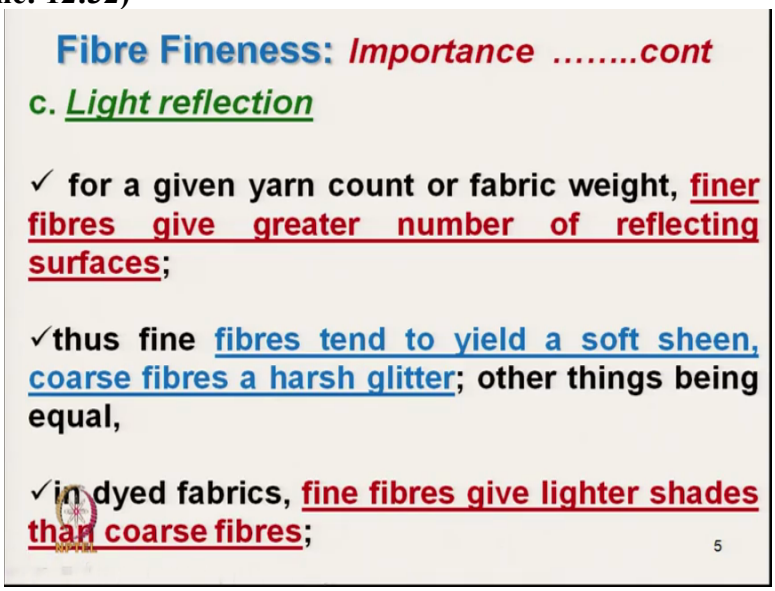

Now light reflection, light reflection also, changes with the diameter of fibre. For a given yarn count and fabric weight, finer fibres give greater number of reflecting surfaces. Because it is a finer the fibre, higher is the specific surface area. So, more reflecting surface will be there in case of finer fibre, thus finer fibre tend to yield a soft sheen, it will give a soft glitter, soft brightness it will give, soft shine, but coarser fibre will give, harsh glitter, because from a particular surface it will reflect, it will start reflecting, so harsh glitter it will give other things being equal.

Also using finer fibre, the light reflection characteristic can be changed because in, so if we use finer fibre, we can produce same characteristic of yarn by imparting less amount of piece. So if we see, this is a coarse fibre, due to this other characteristic like higher like more surface area, more contact area, ok, higher strength availability, using finer fibre we can impart, less amount of twist, to have same quality of yarn.

But if we want to get the same strength, or same other characteristics, for coarser fibre we have to impart higher quantity or higher amount of twist. So this fibres, fibre arrangement in the yarn, for finer fibre it is more or less parallel to the axis, close to parallel to the axis. Less quantity or less amount of twist we can impart. So, that, that means this fibre surface, the yarn surface is, it can reflect better, in case of finer fibre, because of the less amount of twist, less helix.

So this, that means the yarn made of the finer fibre will be lustrous, will, actually will have better look. But if we impart higher twist, that means the yarn will be little bit dull in result. So that is why if its, when we use the finer fibre, we always use less twist and it also helps, not only in the loop it also helps in the productivity. So if we impart, if we get the same characteristics, by imparting the less amount of twist in ring frame that means it, the productivity, delivery date is higher, ok from date of delivery speed will be higher, for keeping the same spindle speed ok.

So in dyed fabrics, finer fibres give lighter shades than coarser fibres because it is the depth of the amount of the dye of depth is higher in case of coarser fibre. So in that way, depending on our requirement, of depth of shape, we may select the finer fibre or coarser fibre. So, if we need the depth, for higher depth, we can go for little bit coarser fibre. So, that is why it is very important to measure the length, fibre diameter.

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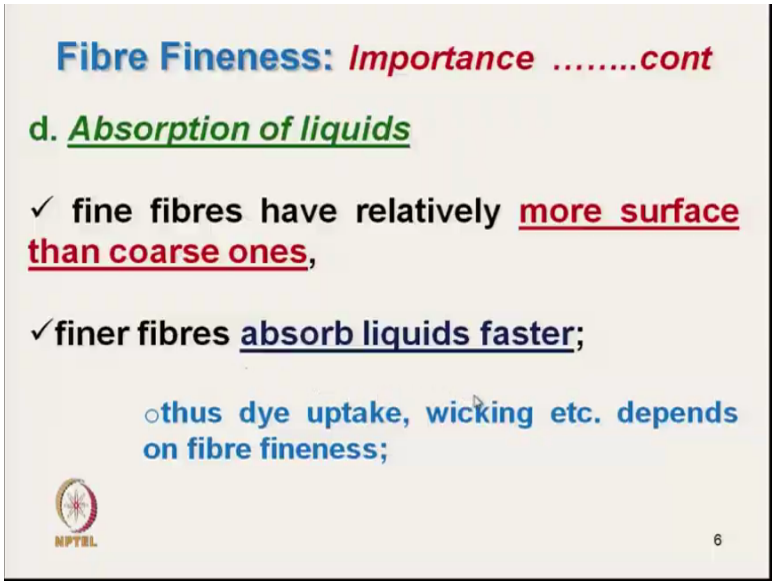

Absorption of liquids, finer fibres have relatively more surface area than coarser ones, for given mass. So, it is specific surface area it is more than the coarser fibre. That is why; the finer fibre absorbs more liquid, higher quantity of liquid. And it absorbs faster. So, that is why its dye uptake is high, wicking is very fast, that is why, the fabric where, high wickability is required, we use finer fibre. Its wickability is high and it depends on the fibre fineness.

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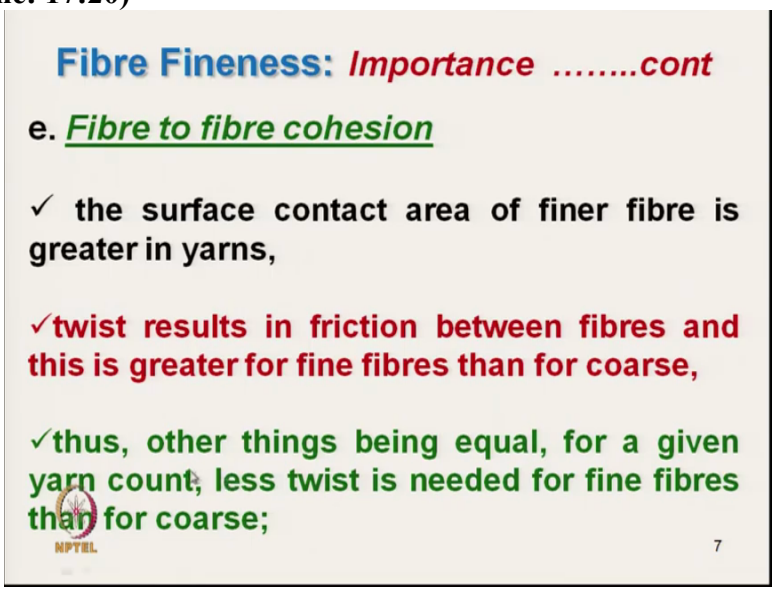

Fibre to fibre cohesion, the surface contact area that I have already mentioned, area of finer fibre is greater in yarn. So, that is why it results stronger yarn. The twist result in friction between fibre, and this is greater for finer fibre than coarser fibre. So that increase in friction, by increasing twist is, effect is more, in case of finer fibre than coarser fibre. And other and thus other things being equal, for a given yarn count, less twist is needed for finer fibre than coarser fibre that we have discussed.

And this less twist will result better loop, better lustre, better uniformity, less hairiness, and that your better weakability, ok , that even it will give the equivalent strength ok.

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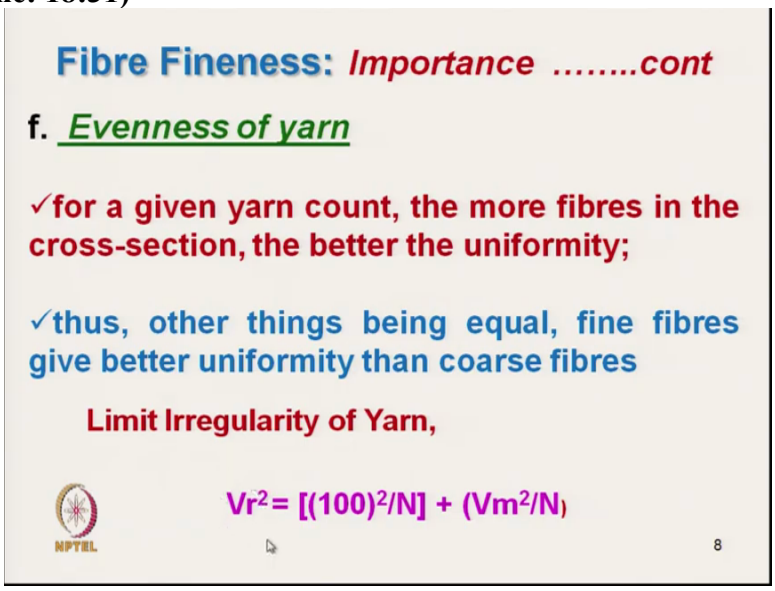

Evenness of yarn, so yard evenness increases with the decrease in fibre diameter, because number of fibres in the cross section is more, when, for same yarn count, when we use finer fibre. So, for a given yarn count, more fibres in the cross section, better is the uniformity. Thus, other things being equal, fine fibres give better uniformity than coarse fibres. So, coarse fibres if we see, it gives less uniformity.

And so if we see the Limit Irregularity, Limit irregularity of the of yarn, its expressed by Vr is the limit irregularity, squared, that is the regularity standard division squared, or CV squared of that yarn, is the 100 2/ N, so N is the in denominator, and Vm 2 / N, Vm is the irregularity of the individual fibre, mass irregularity of individual fibre. So the yarn if you see that the irregularity of the yarn decreases with number of fibre.

So as the number of fibre, that means the number of fibre, we can increase for same yarn count, by reducing the diameter of fibre.

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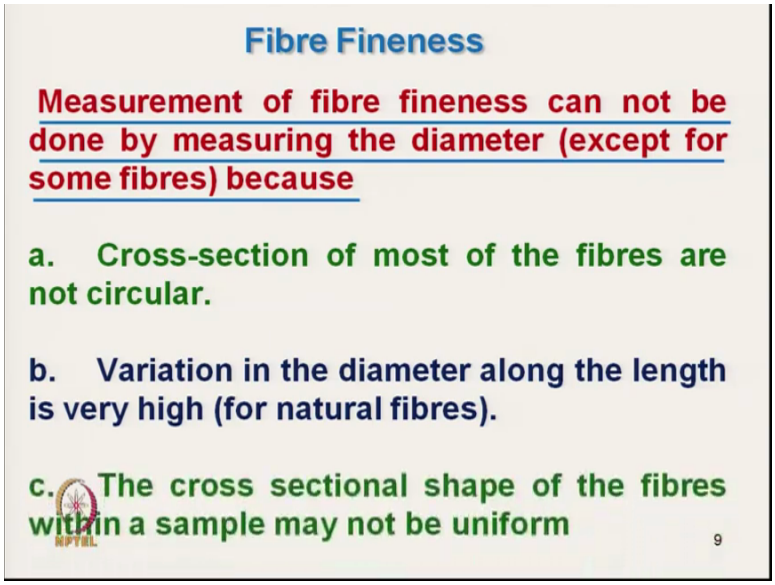

So, measurement of fibre fineness cannot be done by measuring the diameter, so in other engineering material, if we want to measure the fineness, for non measured iron rod or anything, if you want to know the even the wire, metallic wire if we want to measure, the fineness, it is expressed in terms of diameter. Because that diameter is, measurement of diameter of any wire ok.

It is a metallic ware, it is a possible by measuring the, because it is a uniform in nature, thorought the length, the diameter is almost uniform ok and most of the case they are circular in nature. The rod or the wire, they are circular in nature that is why, by expressing the diameter, we can measure the fineness. But, main problem with textile fibres are, this is we can measure by diameter.

So, but in textile material, we cannot measure because the problem is that, cross section of most of the fibres are not circular. So we do not get the circular fibre. Except very few like, synthetic fibre, it is ok but synthetic fibre again will see, although, if at all the spinner rate is circular but sometime if we find that due to various thermo, mechanical, characters, thermo mechanical action, the circularity gets distorted.

And also there are many other fibres, many other manmade fibres, their cross section are not circular in nature. Like trilaval or different types of special structure. So these are not circular and most of the natural fibres, they are not at all circular. Except, wool, wool has got little bit circular in procession. So, that is why diameter measurement of fibre is not normally we do and also the fibre diameter is very, very small it is very difficult to measure the diameter.

So it is in micron. So measurement of diameter directly it sometime it creates problem, ok. So that is why we do not measure the in general, we measure the diameter of fibre as the

parameter for fineness. So, cross section are not circular, and second problem is that variation in diameter along the length is very high. So, where to express, where to express the fibre diameter?

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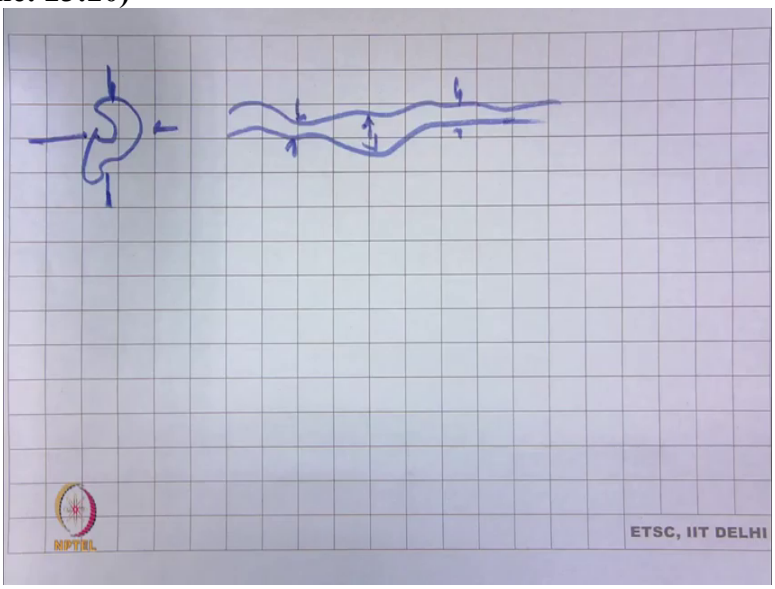

So if we see the fibre cross section is not uniform. We cannot express, we cannot take the diameter. Which diameter should we take? So that is not the thickness we use it is non uniform. Another problem is that, along the length fibre, the diameters are not uniform. Majority of the natural fibre, they grow like this, so diameter expressing the diameter, it is very difficult, because it is very highly variable, particularly for natural fibre.

And third problem is that, the cross sectional shape of fibres within a sample may not be uniform. So, if you see the cross section, of say cotton fibre, So this is cotton fibre, if we see a particular lot, we will see fibre with different cross sectional shape, so there is no uniformity in the cross section, so different cross section are there. So due to all these 3 problems, we normally do not take, fibre diameter, as a measure of fineness, ok.

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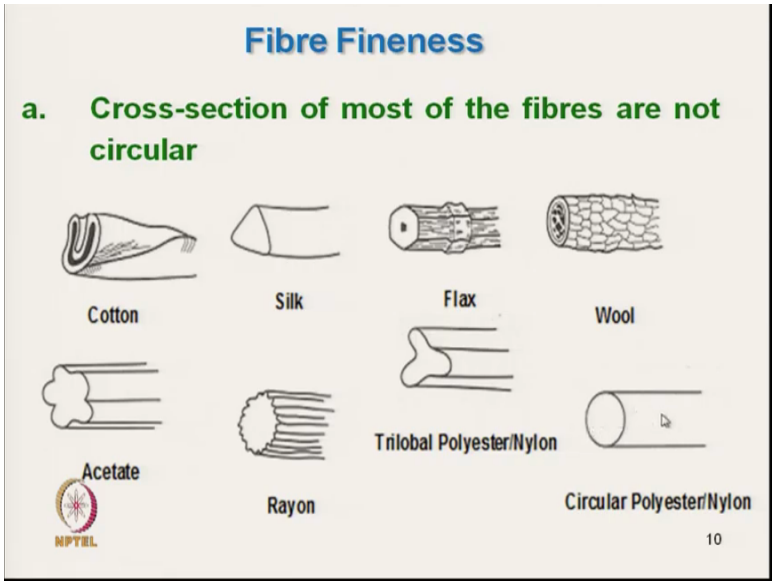

Now first problem was, the cross section, of most of the fibres are not circular. Let us see the cross section of normal, known fibre, ok. This is cotton; it is like bean type structure, cross section, so we cannot measure the diameter. And also it is vary; it varies from place to place, ok. See it is not circular; it is trilobal, triangular type cross section. Flax, it is little bit hexagonal shape, so we do not have any circular cross section ok.

Wool, although wool is little bit in the circular that is why woolly in case of wool we express the fineness in terms of diameter. Wool is the only fibre where we express the fineness in terms of micron ok. That is why it is circular in nature. But still the diameter variation of wool is very high. It is may be 25%, 25% to 30% diameter variation, but still we can measure the diameter of wool fibre.

See this is synthetic fibre, Acetate fibre. It is not circular. Rayon, sedated structure we cannot measure the diameter. And Trilobal Polyester; although circular polyester are there, we can measure. But main problem is that as I have said, it has a very fine diameter. So, measurement is difficult, ok. Next is that, variation in diameter, along the length. So along the length if you see, particularly for natural fibre, diameter varies. So, it is not good idea to measure the diameter ok.

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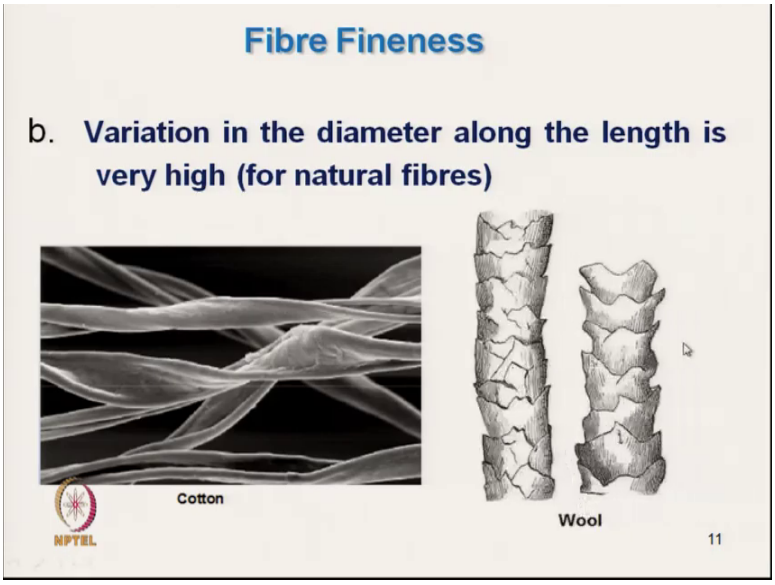

So this is the, so at different portion, this is cotton, at different portion if you see the thickness changes. So we cannot measure the diameter of the fibre. Wool, it is a different structure, ok. that differ, but here although in the face of wool we take, try to take a mean diameter, in terms of micron. But, if you see that for natural fibre, the diameters are not uniform.

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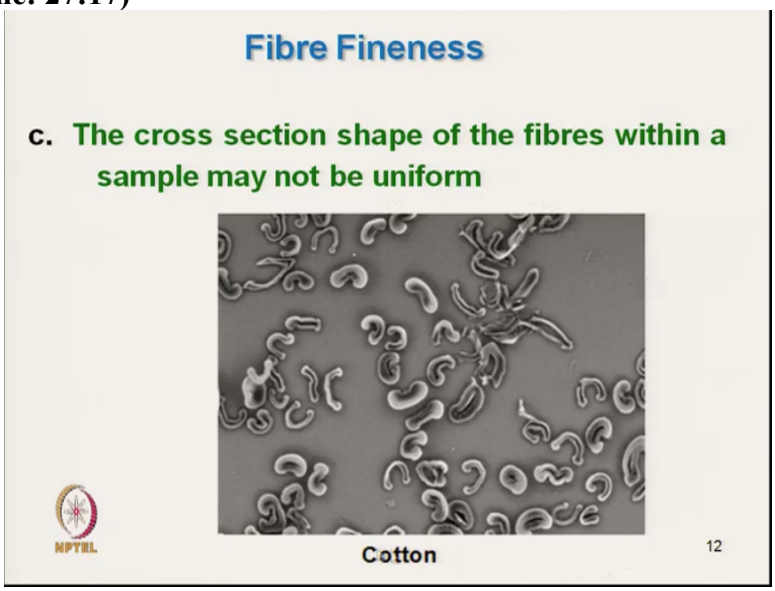

The cross sectional shape, of fibre within a sample, may not be uniform. So, if you see this is the cotton fibre, the cross sectional shape of cotton fibre of different cotton fibre is totally different. There is no uniformity. So, we normally do not measure the diameter here.

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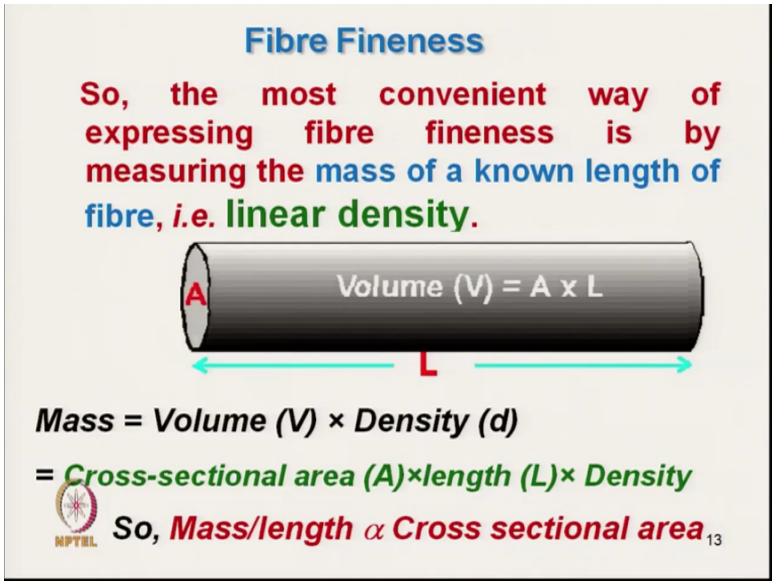

So, the most convenient way of expressing the fibre fineness is by measuring the mass of known length that is linear density. So, our idea is to measure the cross sectional area of the fibre. So if you see the mass per unit area, unit length, the mass per unit length, or linear density it is proportional to the cross sectional shape. Let us see how. This is one fibre, for our convenience, we have taken a cylindrical fibre, cylindrical shape ok.

And volume is cross sectional shape, cross sectional area by length. So Mass = volume * density, and that is the cross sectional area multiplied by length, it is the volume, and it is the density. So mass per unit length, M/L, and for keeping the density constant, for a particular fibre, density remains constant. So you can say mass per unit length is proportional to the cross sectional area ok.

This is the cross sectional area, So that means, so it is justified, that if we measure the mass per unit length, either it is circular or not, does not matter. Mass per unit length, is always proportional to the cross sectional area ok. So, that mass per unit length, gives the idea about the cross sectional area, for the same fibre. That means the fibre with higher mass per unit length, we have higher cross sectional area.

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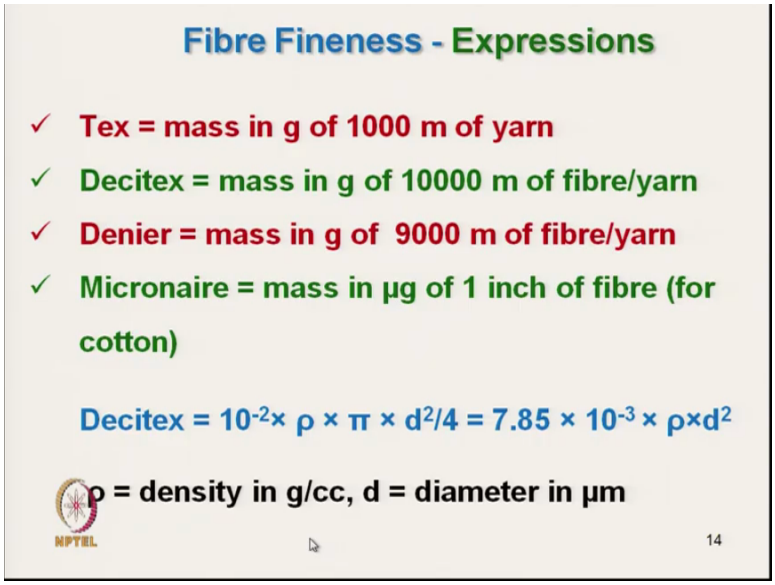

So, how to express the fibre fineness? We can express the fibre fineness in terms of Tex ok. That is in direct system. It is a Tex, it is a mass in gram of 1000 meter of yarn or fibre ok, So, most of the fibre fineness are expressed in the direct system. It is a mass per unit length, we need to measure. So, Decitex it is a, decitex is a, tex is normally used for yarn, and decitex normally we use for fibre. It is a smaller in unit. That means mass in gram per 10,000 meter of fibre.

So that is the decitex. Denier is mass in gram of 9000, 9 kilometre fibre. We have that mass, suppose decitex is x so if we take the nine, the denier is x, if we take nine kilometre of yarn the mass will be the x gram. Ok, But this tex, decitex or denier, they are normally used for synthetic fibre, manmade fibre. And for cotton there is another system it is called micronaire. Micronaire is expressed in terms of mass in micro gram for 1, for 1inch of fibre, what is that?

If we take the mass, that will be micronaire ok. And we can convert the micronaire to denier, denier to tex, the conversion is simple. That means, by measuring the micronaire of cotton, we can actually measure the cross sectional area. Now decitex we can calculate directly using this formula, and where row is the density of fibre in gram per cc and d is the diameter in micro gram. So if we can, if we know the decitex and the density of the fibre, then we can calculate the diameter or vice versa.

This is for circular fibre, assuming that the fibre is circular in nature. But decitex is actually proportional to square of diameter.

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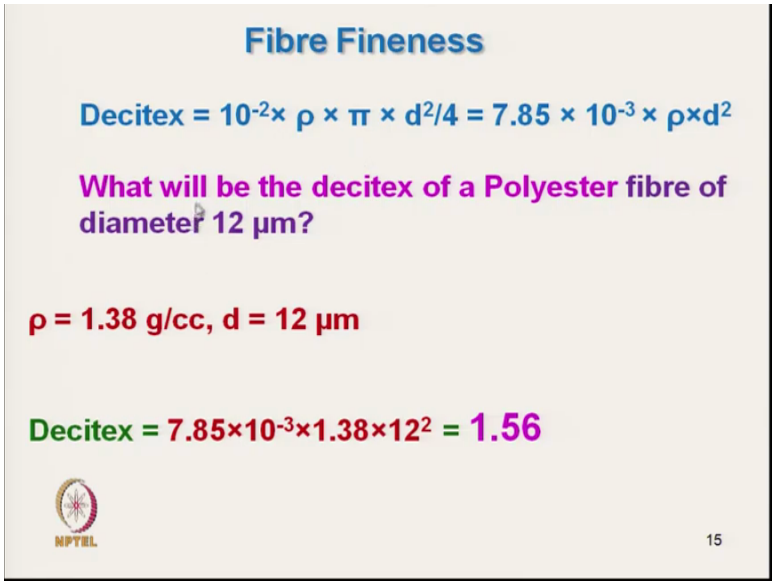

So, let us see what will be the decitex of a polyester fibre of diameter 12 micron? So diameter is given, it is a 12 micron, diameter is given, so you would like to know the decitex or denier. So by using this formula directly, we can measure the decitex, ok. The density of polyester is 1.38 g/cc and the diameter is in within 12 micron. So decitex will be using this, here diameter will be in micron, ok, directly we use which is the decitex of fibre. So, directly we can measure. So this type of problems we can actually solve, by directly, using the formula.

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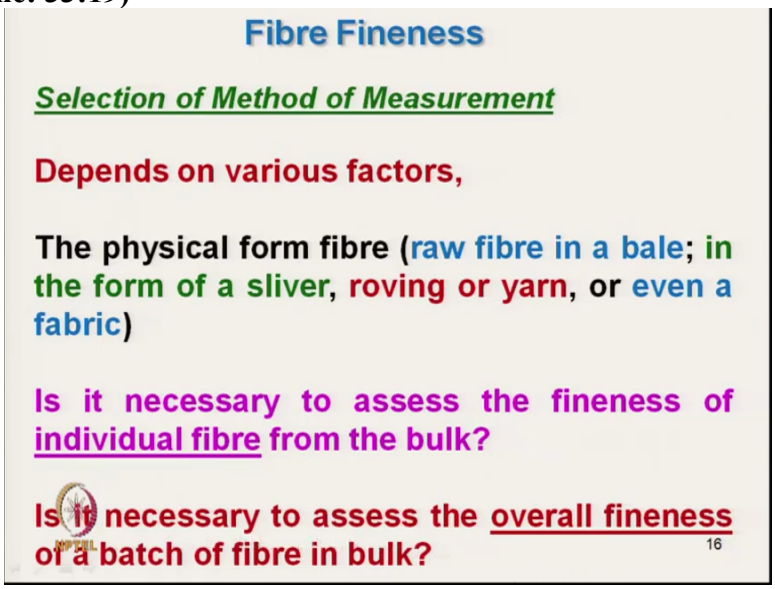

Now we have to now select. There are various methods of measurement. We have to select which methods are to be, is to be actually adapted, ok? The, the, what are the methods we have to adapt, so this methods depend on the various factors, first is the physical form of fibre, ok, whether it is a raw fibre in bale form, in the form of sliver or if it is from the roving, or from the yarn or even from the fabric.

So, if we want to measure the fibre diameter, or fibre fineness from fabric, we will not be able to get large quantity of fibre. On the other hand, if we have large quantity of fibre, we have

to; we use particular method, ok. And if we have very few fibres, we can use different methods. And also there are methods, which we can get directly, and another method which we can get indirectly, the fibre cross sectional area.

It is necessary to assess, so is it necessary to assess the fineness of individual fibre from the bulk? So, do we want to measure the fineness of individual fibre? Or is it necessary to assess overall fineness of the batch of fibre in the bulk, so if we want to know the overall fineness, we have to adapt different methods, if we are to measure the fibre fineness of individual fibre, then we have to adapt different methods so methods depending on these factors.

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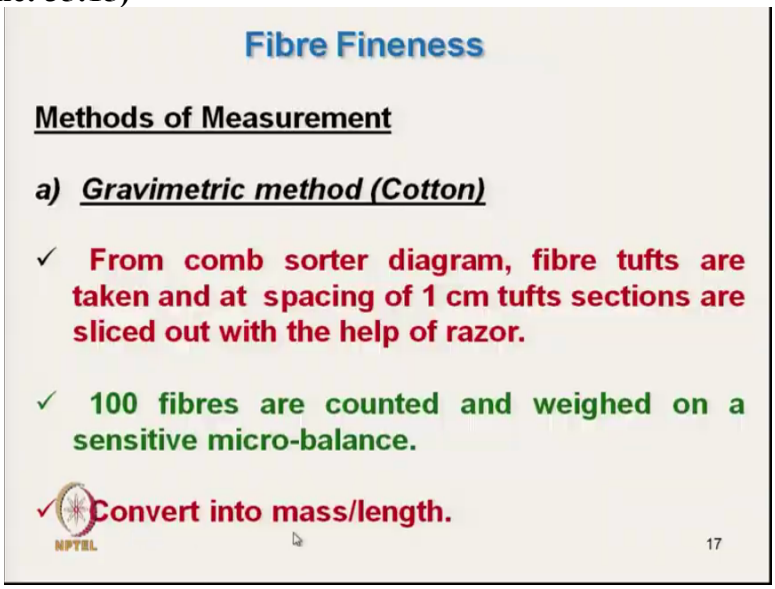

First is that Gravimetric method, of measuring the fibre fineness. It is basically it is by taking the mass of fibre. From the comb sorter diagram, fibre tufts are taken, at spacing of 1 cm tufts, ok, sections are sliced out with the help of razor.

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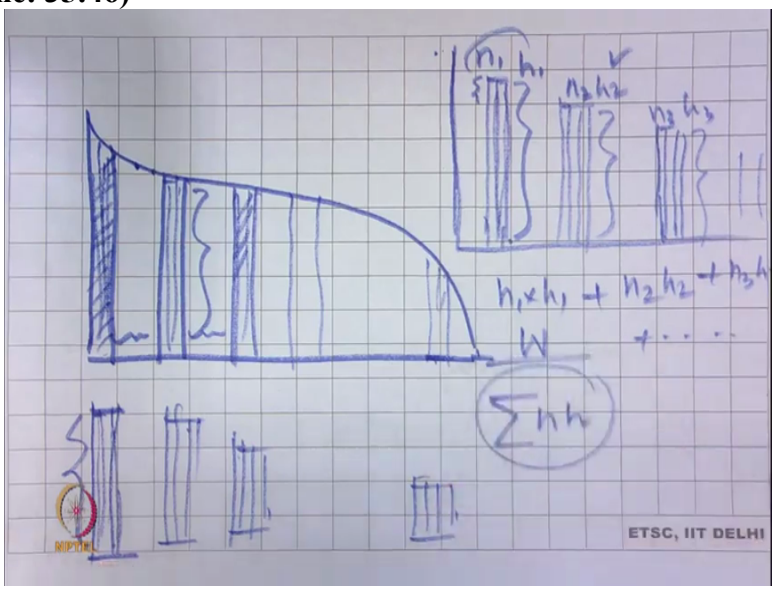

Now, let us see this is Comb sorter diagram, from here, we are measuring, and we are taking out the fibre. This is few fibre we are taking, and after say 1 cm distance, this is 1 cm distance, we are taking another set of fibre. ok and these fibres we are; whatever number of fibres, we are taking from, after one cm another set we are trying, ok now this segment of fibre, when we are getting, now this is the segment, these are the fibre are taken out and then we are slicing the edge, to make it uniform, ok, to make it uniform.

So this is the actual fibre, from here also, we are taking a, this fibre, and then again cutting, ok. And here also it is smaller one, and we are cutting it, from here also we are taking smaller fibre and then we are cutting. Now from different portions, we have taken and then what we are doing and it is a sliced out with the help of razor. 100 fibres are counted and weighed on a sensitive micro-balance ok.

At different places we are taking, so we know the length of individual fibre, and such 100 fibres we are counting. And then we are taking the mass. So, we want to measure the actually mass per unit length, so we know the length, individual 100 fibres we know, we know the individual fibres length and then we can measure the mass. Why are you taking from the different zone because, the longer fibre, for cotton, the longer fibre, will have higher diameter, always.

The longer fibre it is the matured fibre, that is why normally it is a natural fibre, it is a little bit higher diameter, and short fibre is little bit, immature fibre or not fully grown, so that this fibre will be normally it is a lower in diameter, to make it average; to average out we take the fibre from different source, different position, so short fibre and long fibre also and then we are getting the mean fibre linear density ok, and we convert it to mass per unit length.

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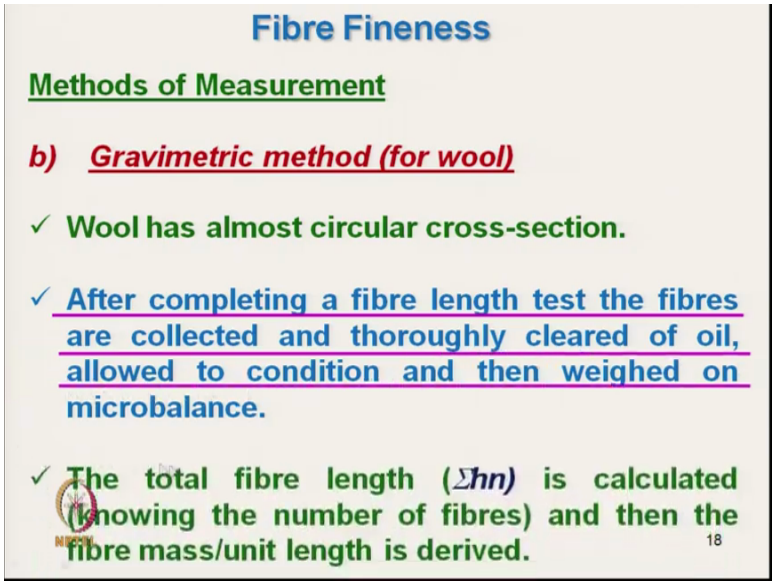

Next is that same method, Gravimetric method for wool fibre, this is little bit different, where wool has almost circular in cross section, so we have, we know the wool fibre, circular in cross section, so we can measure either mass per unit length or measure the diameter. So after completing the fibre length test, the fibres are collected and thoroughly cleaned of oil, because during fibre length test, when we take the fibre from the comber or from the carding, it contains oil.

So, oil content it is there, so it will affect the diameter of fibre. So that is why we have to clean the fibre and then dry and allow it to condition ok, so after conditioning, we have to take the weight, in the micro balance ok. Now, the total length is sigma hn ok, that means it is calculated knowing the number of fibres, in each group and then the fibre mass per unit length is derived.

Now this is suppose first of all wool fibre, wool fibre length, so we, what we do, we take from different length group, this is one length group, this is another length group, ok so the length group range should be around 3 mm. So around 3 mm length group, fibres of mass per unit length, so this length groups are there, here, this is another length group, here we have another length group, so in this length group, the length, here the length is say h, ok, h length, h1. And here, number of fibres n1.

This length is say h2 and the number of fibres is n2. Here it is h3 and number of fibres is n3. So in this way, we can take any number of fibres groups. So here in this length group, what is the total fibre length? n1 x h1. That is the total fibre length. In this group what is the fibre length? n2 x h2, n3 x h3 and so on. So, if we add all these things, all these group, so nh, this shows the total length of the fibre.

Total length of fibre and if we take the mass of all these groups, then it will be, the mass will be, mass is W, then it will be mass per unit length ok. That is the fineness of fibre.

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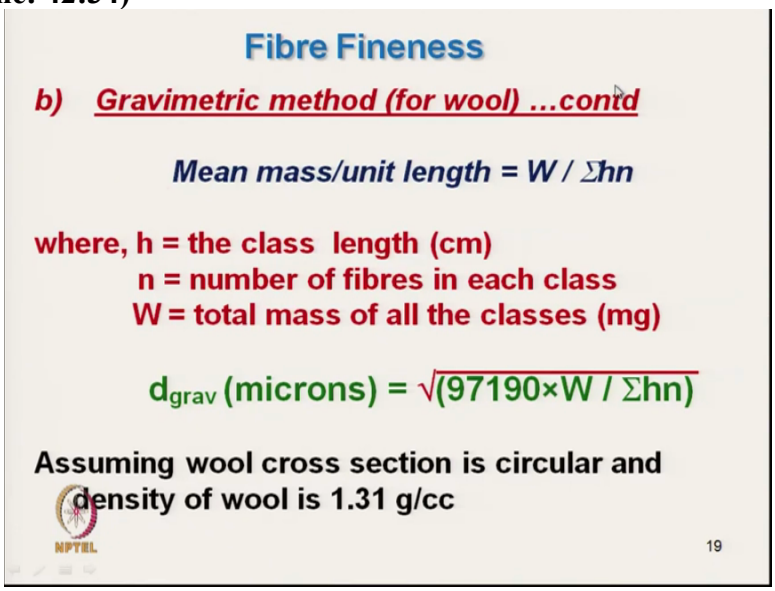

You can see in Gravimetric method of wool, the total mass of all; mass of fibres of all class is in milligram and h is the class length in cm, that particular class you want to take, and n is the number of fibre in that particular class, each class, ok. So in that way we can calculate the mass per unit length. Now, here mass per unit length is of the unit, mg / cm is the unit here, so, mass per unit length.

Now as wool is circular in cross section as we have mentioned, this wool fibre, which we can get, we can convert this mass per unit length, into diameter of fibre. This diameter is known as gravimetric diameter. So, there are 2 types of diameters, one is direct diameter of wool fibre another way is that, gravimetric diameter. If we know the mass per unit length of fibre, then we can convert into gravimetric diameter, here W unit is mg and length unit is cm. Now let us see how to convert, how we get this constant 97190 ok.

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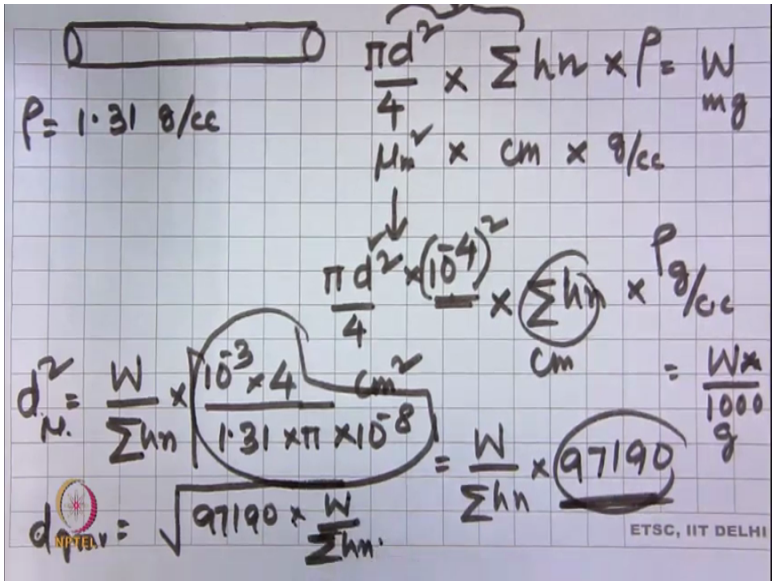

Now, if you see, this is a fibre, ok, total fibre length, and the cross section is the Pi d 2 / 4 ok, d is in micron, we want to know in micron, ok. Length, total length, what is the total length? hn is the total length of the fibre. Then, cross section, area and length. This gives the volume of the fibre; this is giving the volume of the fibre. If we multiply by the density, we will get the mass of the fibre, mass in say, milligram ok and now here it is given, the density as per this formula we have seen, this unit is that micron squared.

Because diameter in micron, length unit was in cm, density unit was in gm/cc, and mass unit was in mg. This was the unit given, now what we are trying, we are trying to get the this constant, now density is 1.31, density of wool is 1.31 gm/cc. ok now if we see here, the if we try to convert in terms of cm, so this if we convert, Pi d 2 / 4 d 2 into 10 to the power - 4, that means cm squared, that is 10 to the power -4 means, it is a, it will come into square, that is it is in a from micron to cm squared, micron square to cm square we converted.

So it is becoming cm squared unit, ok. Now it is cm unit, so this is remains same, this is cm unit, ok. That means cm cube and this unit is g/cc Rho remains same, and this is, there will be total unit here, it is becoming gram so we have to convert into in terms of gram, so W/ 1000, that means W / 1000. This unit becomes gram, ok. Now if you see the d 2, this d 2, we are just rearranging this, d 2 become, W by this one, this to go the other side, then now, let us see the constant, this constant and this 10 to the power of -3, ok and this becomes 4, here this is the g/cc will go to other side, 1.31 and this Pi will go here, and this will be 10 to the power -8.

This, this will go in other side. So if you see this value, total value of this, this will come round to be W/hn * 97190, approximately. This value, this is the value we are getting, it is 97190, that is why this is in micron, so d grav equal to under root 97190 approximately, *

W/hn, This is the way we get this constant value 97190. So that is the Gravimetric diameter of wool, is this ok under root, 97190 * W under root, this sigma hn.

So, this is the total length of fibre, So, assuming wool is the circular infra section, and the density of wool here is 1.31, So this is the way we are getting this constant ok.

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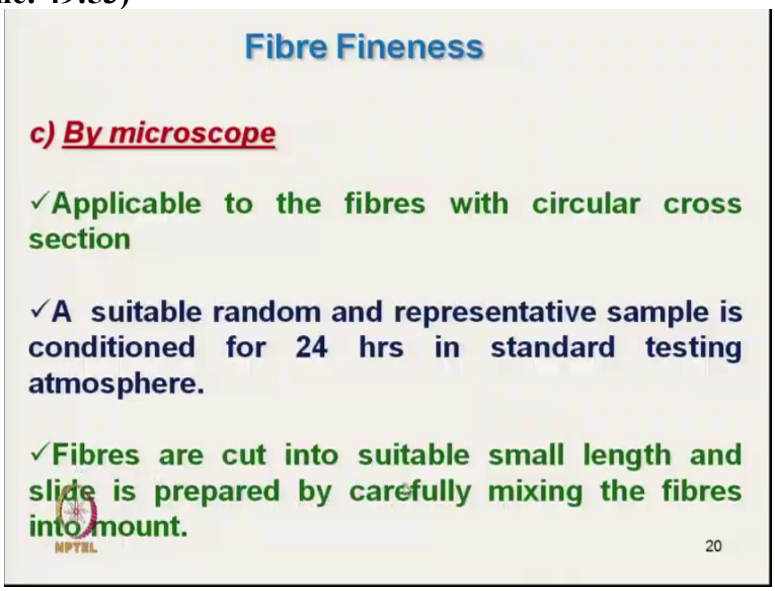

Next method is that, by microscopic method, microscopic method we only use, when the fibre diameter is circular, cross section of fibre is circular. It is applicable to the fibres with circular cross section. A suitable random an representative sample is conditioned for 24 hours in standard testing atmosphere. So, for any fibre than we can measurement, it is very important to condition.

Because if we do not condition, because most of the fibres are fibroscopic in nature and by observing moisture, it gets swelled so, we will get totally wrong result, if we do not get the fibres conditioned ok. So, for same fibre with different atmospheric condition, different humidity level, the diameter changes, so for measuring diameter, we have to first condition properly. Then fibres are cut into suitable small length, because we will measure the diameter under the microscope, very small length we have to cut.

And the slide is prepared by carefully mixing the fibres into a mount. Some mounting material should be there, some mounting chemical has to be there. One care, utmost care has to be taken, for selecting mount is that, it should not swell the fibre that is very important ok, fibres should not get swelled. So mount is important because it has to actually place the, keep the fibre in stand, in its position, when it is placed in the slide.

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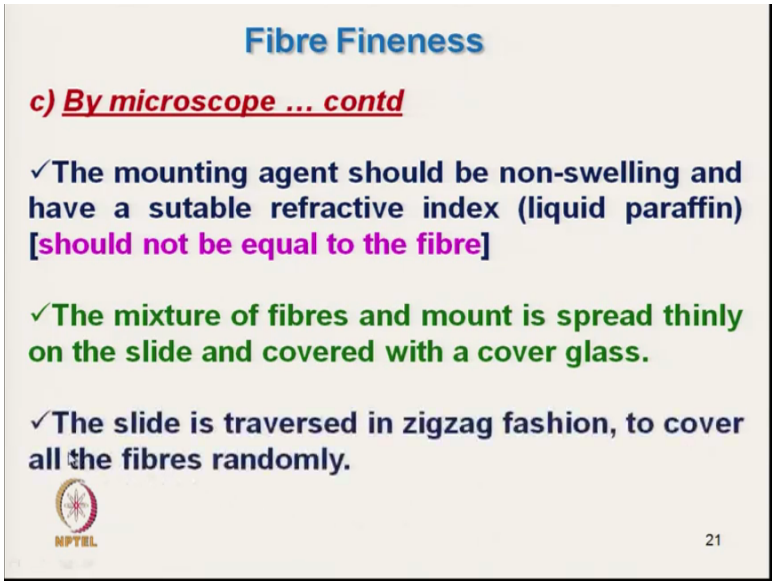

The mounting agent should be non swelling and have suitable refractive index, ok, normally liquid paraffin is used. Now, why refractive index? Refractive index is here it is extremely important, because if we use, the refractive index of mounting agent, which is equal to the fibre, then problem would be that the fibre would not be visible. Fibre will be actually optically dissolved; optically it will be, totally vanished. We will not be able to see.

So, that fibre refractive index, it should not, match with the refractive index of the mounting agent, so otherwise, will not be able to see. This, this technique we use, when we measure the fibre, cross section and by, optically dissolving the fibre, Q fibre, we can see the other fibre. The mixing of fibre and mounting agent is spread thinly, so there should be mixing, properly mixing, and it should be, thinly spread on the slide, covered with the covering glass.

So it should be uniformly distributed, it should not be clustered. The slide is then traversed in zigzag fashion, so that we can take the fibre diameter from different position, different portion and we can cover maximum number of fibre, ok. It should be in zigzag fashion, to cover all fibre randomly.

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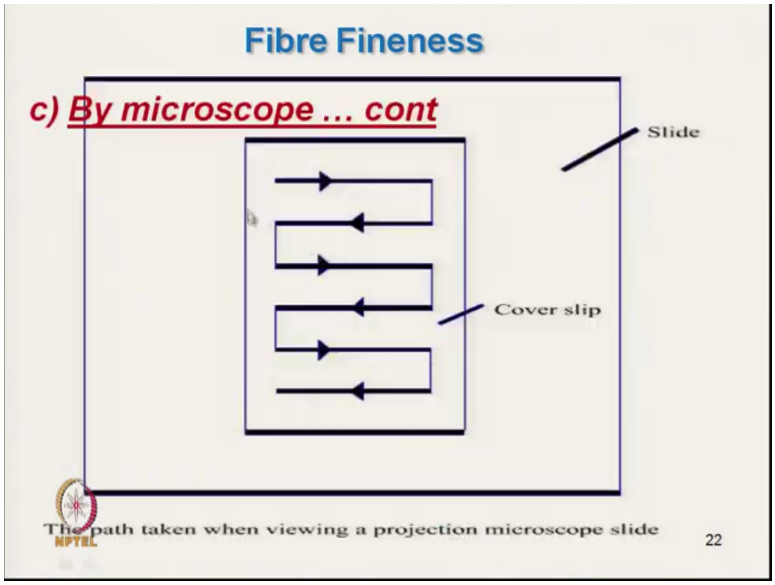

This is the way the fibre, the slides are moved ok, this way the slides will be moved so that we take the reading from different portion. Majority of the fibres are actually covered ok, now we will continue with the measurement techniques of fibres in the next class, till then thank you.