# Physical and Dimension Properties of Textile Fibres

Fine Structure & Appearance:

- The Surface structure of a fiber is most important in that it control the behavior of the fiber in the yarn or the fabric.

- The scaly surface of the wool fibers for e.g. feel uncomfortable. However, the rough scaly surface of wool enables individual fibers to grip one another when twisted together as a yarn.
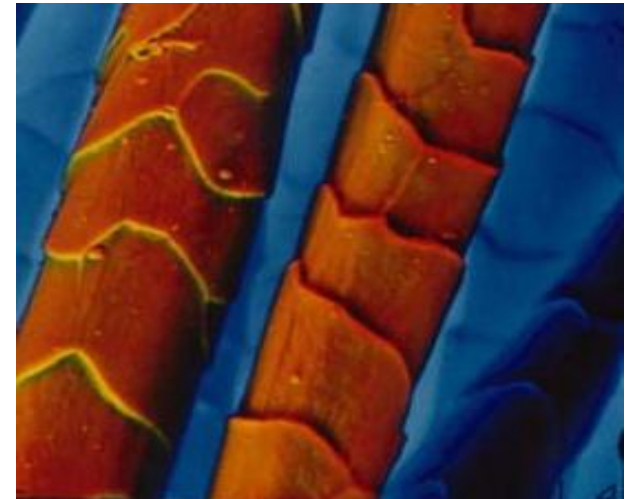
Fine Structure & Appearance:

- The cotton which have a flatter ribbon-like cross section The convolutions of the cotton fibers, similarly, enable fibers to grip one another when spun.

- On the other hand nylon fiber have a circular cross sectional structure. The smooth surface of the fibers affects the lustrous appearance of the fabric and smooth surface may not cling the dust and dirt as readily as rough surface do.

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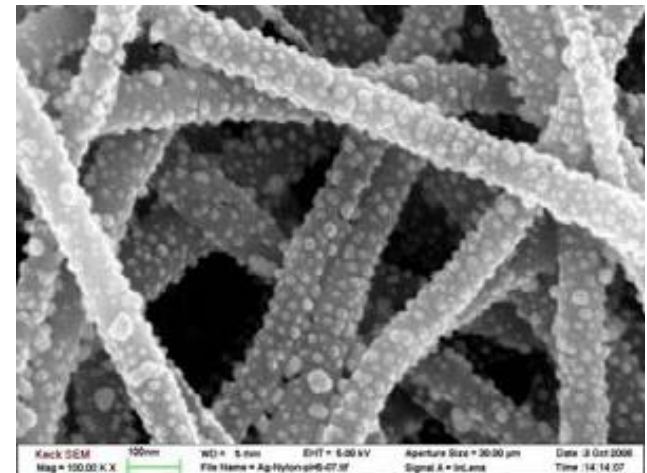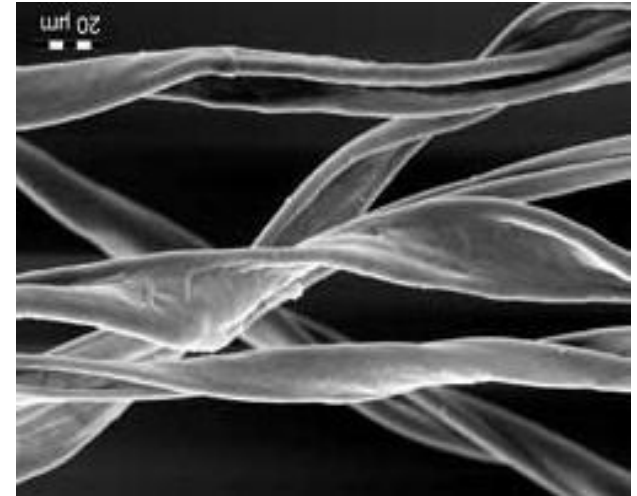
YARN COUNT/YARN SIZE/ YARN NUMBER

For Staple Yarn and Filament <u>Linear Density</u> also known as Yarn Number or Yarn COUNT
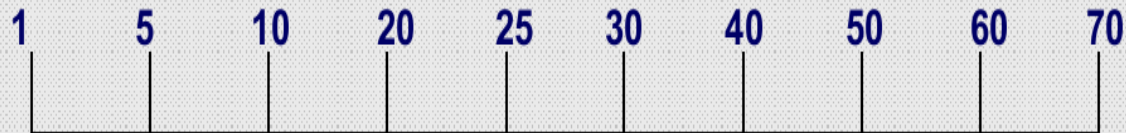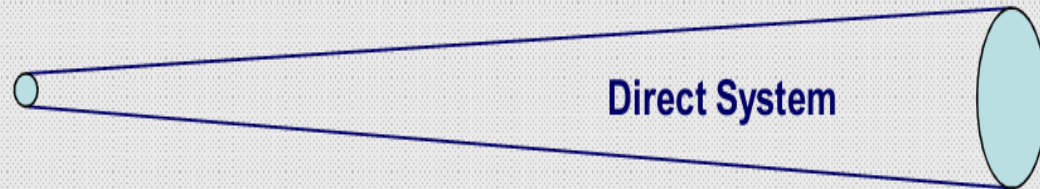
The count of a yarn is a numerical expression which defines its Fineness or Linear Density

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The different systems of expressing the yarn number are:

> 1. **DIRECT SYSTEM**
>
> 2. **INDIRECT SYSTEM**
>
> 3. **UNIVERSAL SYSTEM OR TEX SYSTEM**

Theses systems depends on the material used for preparing the yarn are

Indirect System

| 70 | 60 | 50 | 40 | 30 | 25 | 20 | 10 | 5 | 1 |

Direct System

| 1 | 5 | 10 | 20 | 25 | 30 | 40 | 50 | 60 | 70 |

weight per unit of length of yarn

DIRECT SYSTEM (Denier)

weight per unit of length of yarn

- The unit of length remains constant.
- This system is used for silk and manmade fibers.
- The smaller the number, finer the yarn.
-

$$\text{Denier} = \frac{\text{Weight in Grams}}{\text{Length in 9000 m}}$$

INDIRECT SYSTEM (Count)

length per unit of weight of yarn

- The unit of weight remains constant.

- It is used for cotton, wool, worsted yarns and linen etc.

- The lower the count ,the coarser the yarn.

- This system is also referred as Cotton system.

- The **count** of the yarn is defined as **number of hanks per pound.**

Cotton Count

- For cotton yarns, the "English" or "cotton" count is used to express yarn fineness.

- The unit of length in an "English" count system is the hank, 840 yd, and the unit of weight is 1 lb.

No. of (840 yards) / 1 pound

INDIRECT SYSTEM (Count)

English

▶ The English Count is defined as the numbers of hanks of 840 yds in length that weigh one pound in weight.

1
840 yds

5
4200 yds

10
8400 yds

20
16800 yds

40
33600 yds

1 lbs
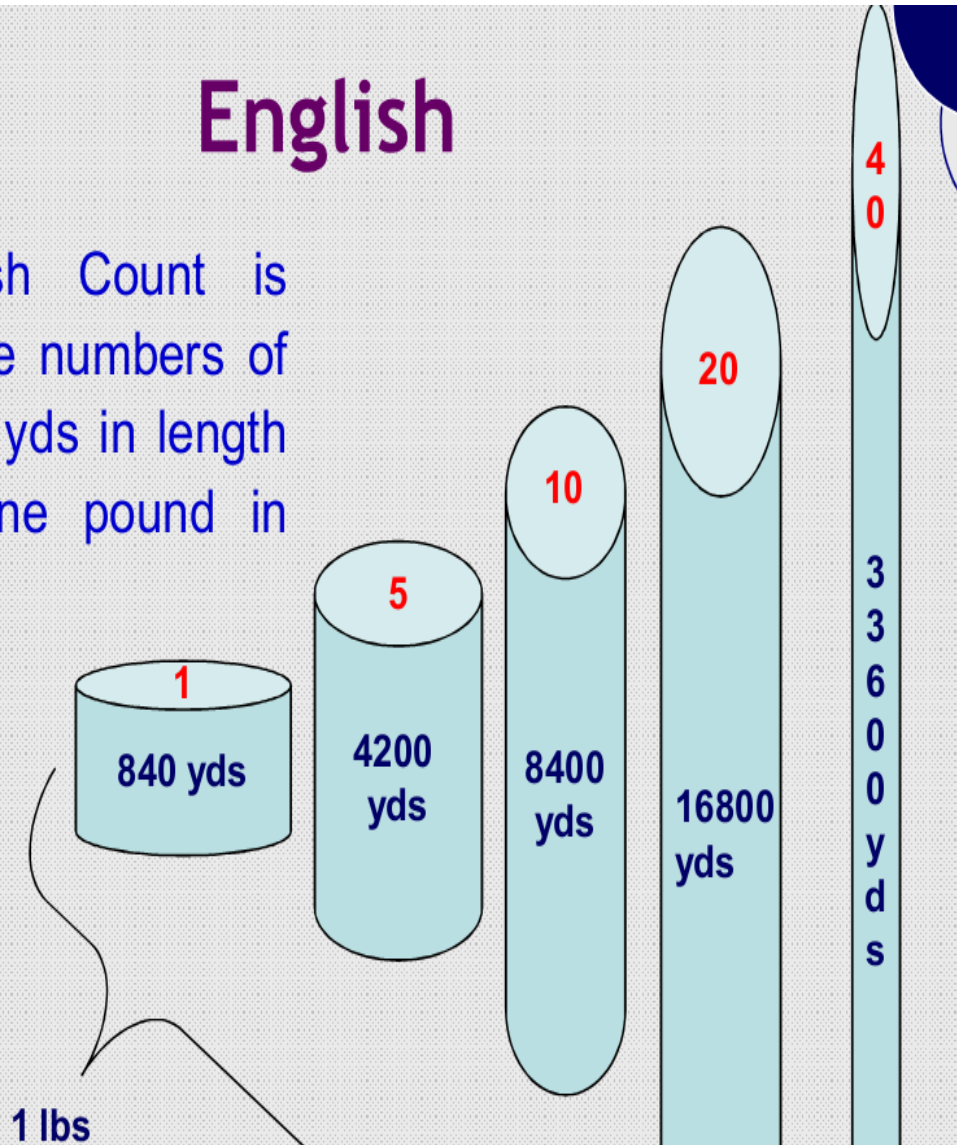
UNIVERSAL SYSTEM (Tex)

- Tex system can be used from fiber to yarn stage.

- This is a direct system of yarn numbering.

- It is applicable to both natural and synthetic yarns.

- Tex is defined as the weight of the yarn in grams present in 1000 m or 1 km length.

$$Tex = \frac{Weight \; in \; Grams}{Length \; in \; 1000 \; m \; or \; 1 \; km}$$

UNIVERSAL SYSTEM (Tex)

1000 mtrs
or
1 Km

1 gm

10 gm

30 gm

40 gm

50 gm

1 10 30 40 50
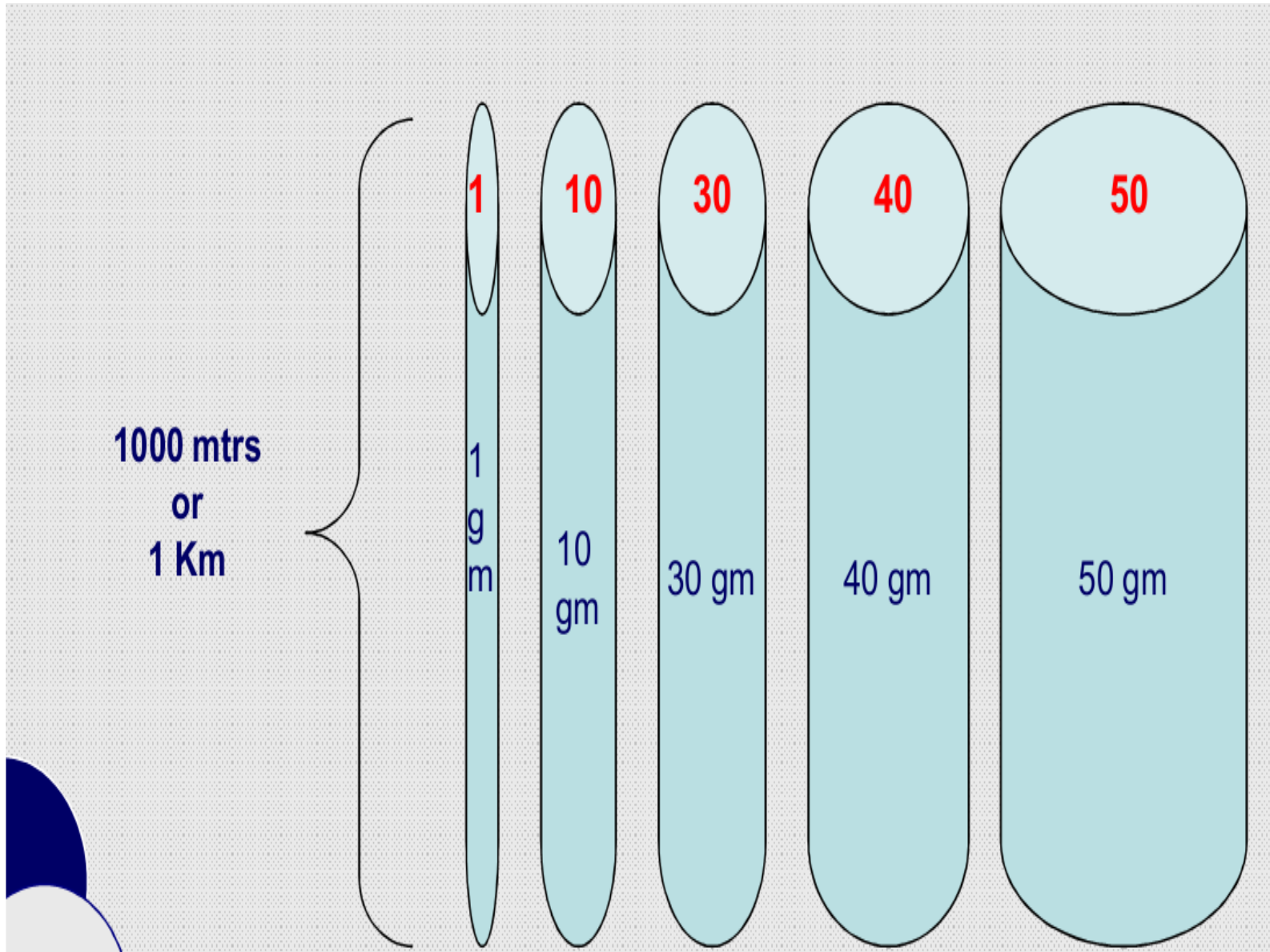
Fibre Length

- Fibers length may vary considerably with in any sample. The variability may as high as 40% for cotton and about 50% for wool.

- Man made fibers (Staple) are more generally much uniform, however they may vary as 10%.

- Man made filament can be produce in any length to meet the requirement of the spinner

- Staple yarn (short length yarn) are made by aligning the staple fibers into a waves or less parallel bundles form and then twisting is done so that the fibers are held together in the yarns.

Fibre Breaking Strength

- It describe the ability of fibers to resist breakage under tension/load.

- It is the breaking strength of any material (fiber/filament yarn and usually describe as tenacity and expressed in grams/ decitex.

- 1 decitex = mass in grams of 10000 meters of yarn or filament. Hence 10000 m of yarn weigh 50 grams; it has a decitex of 50.

- If a 50 decitex yarn just breaks on being loaded with 200 grams, it will have tenacity of as (breaking load/mass per unit length)

Tenacity: 200 ÷50 = 4 g/dtex

Extension or Elongation at Break

- When a force is applied to a yarn or filament it extends & will eventually reach to point, when the yarn snaps.

- If a 100 cm of Jute yarn can be stretch to 120 cm before it snaps, it said to have elongation at break of 20 cm.

- Usually it is expressed as a percentage. In above case the elongation will be 20%.

$$= \frac{\text{increase in length}}{\text{Initial length}} \times 100$$

$$= \frac{20}{100} \times 100 = 20\%$$

Elasticity

- This is a measure of extend which a fiber or filament can recovered from strain.

- When a fiber stretched by small amount and it will return to it original length when the force released.

- Example, if a yarn is stretched by 10% say 100 mm to 110 mm and on release it recovers to a length 100 mm, then it is 100% elastic.

- On other hand, if the yarn recovers to a length of 102 mm. it is 80% elastic.

= (Extension in length on applied force) – (Length on releasing of force)x100

(Total Extension in Length on applied force)

(110-102) x100   = 80%

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Moisture Regain

- All the fibers absorb moisture when in contact with the atmosphere. The amount of the absorbency depends upon the relative humidity of the air.

- In practice, the moisture absorbing properties of the fibers are described and known as "Moisture Regain".

- This is defined as the % age increase in weight when oven dry fiber is allowed to come to equilibrium in air.

- SMR = $\dfrac{\text{Mass of moisture absorbed (W)}}{\text{Mass of bone dry fiber (D)}} \times 100$

  $\dfrac{20 \text{ gram}}{250 \text{ gram}} \times 100 = 8\%$

Moisture Content

- This is the weight of the moisture present in a textile material expressed as a percentage of its oven dry weight (i.e. the constant weight obtained by drying at a temperature of 105 °C to 110 °C.).

- SMC= $\dfrac{\text{Mass of moisture in fibre (W)}}{\text{Mass of moisture in fibre (W) + Mass of bone dry fiber (D)}} \times 100$

- SMC = $\dfrac{W}{(W+D)} \times 100$

$$\frac{20}{(20+250)} \times 100 = 7.4\ \%$$

Textile Fiber	Moisture Regain (MR%)	Moisture Content (MC%)
Cotton	8.5	7.34
Jute	13.75	12.1
Viscose	11.0	9.91
Silk	11.0	9.91
Wool	16.0	13.8
Acrylic	1.5	0
Flax	12.4	10.4
Hemp	12.4	10.4
Nylon	4.0	3.1
Polyester	0.4	0
Acetate	6.0	
Triacetate	3.5	
Rubber	0	
Wool yarn	18.25	
Glass	0	
Metalic	0	