TEXTILE TERMINOLOGY

1.TEXTILE- Originally, a woven fabric; now applied generally to any one of the following- 1. Staple fibers and filaments suitable for conversion to or use as yarns, or for the preparation of woven, knit, or nonwoven fabrics. 2. Yarns made from natural or manufactured fibers. 3. Fabrics and other manufactured products made from fibers as defined above and from yarns. 4. Garments and other articles fabricated from fibers, yarns, or fabrics when the products retain the characteristic flexibility and drape of the original fabrics

FIBER: A unit of matter, either natural or manufactured, that forms the basic element of fabrics and other textile structures. A fiber is characterized by having a length at least 100 times its diameter or width. The term refers to units that can be spun into a yarn or made into a fabric by various methods including weaving, knitting, braiding, felting, and twisting. The essential requirements for fibers to be spun into yarn include a length of at least 5 millimeters, flexibility, cohesiveness, and sufficient strength. Other important properties include elasticity, fineness, uniformity, durability, and luster.

YARN - A continuous strand of textile fibers created when a cluster of individual fibers are twisted together. These long yarns are used to create fabrics, either by knitting, plaiting, or weaving.

FABRIC: A planar textile structure produces by interlacing yarns, fibers, or filaments.

WEAVING- The method or process of interlacing two yarns of similar materials so that they cross each other at right angles to produce woven fabric. The warp yarns, or ends, run lengthwise in the fabric, and the filling threads (weft), or picks, run from side to side. Weaving can be done on a power or handloom or by several hand methods.

KNITTING - The art and science of constructing fabric by interlooping of yarn loops, through the use of needles and a "loop within a loop". The most essential unit in a knit fabric is the loop or stitch. A vertical row of stitches is called a WALE; the horizontal or crosswise row of stitches is known as a COURSE. The number of wales per inch, measured across the fabric depends on the count or size of the yarn used, and the number of needles per inch in the machine. The two major classes of knitting are warp and weft.

DYEING: A process of coloring fibers, yarns, or fabrics with either natural or synthetic dyes.

PRINTING- A process for producing a pattern on yarns, warp, fabric, or carpet by any of a large number of printing methods. The color or other treating material, usually in the form of a paste, is deposited onto the fabric which is then usually treated with steam, heat, or chemicals for fixation.

DESIGN-A design is a plan or specification for the construction of an object or system or for the implementation of an activity or process, or the result of that plan or specification in the form of a prototype, product or process

LAYOUT-The placement of pattern on the fabric, in an economical manner, that is without wasting fabric is known as pattern layout. All the patterns should be arranged prop-erly following grain of the fabric. Example the bodice centre front will be in straight (lengthwise direction) grain.

WARP- 1. The set of yarn in all woven fabrics, that runs lengthwise and parallel to the selvage and is interwoven with the filling. 2. The sheet of yarns wound together on a beam for the purpose of weaving or warp knitting.

WEFT - In woven fabric, the filling yarns that run perpendicular to the warp yarns.

SELVEDGE - The thin compressed edge of a woven fabric which runs parallel to the warp yarns and prevents raveling. It is usually woven, utilizing tougher yarns and a tighter construction than the rest of the fabric. Other names for it are listing, self-edge, raw edge.

COURSE - The rows of loops or stitches running across a knitted fabric. Corresponds to the weft or filling in woven goods.

WALES - In a knitted fabric, the series of loops that are formed by a single needle, which runs vertically or lengthwise in a knitted fabric.

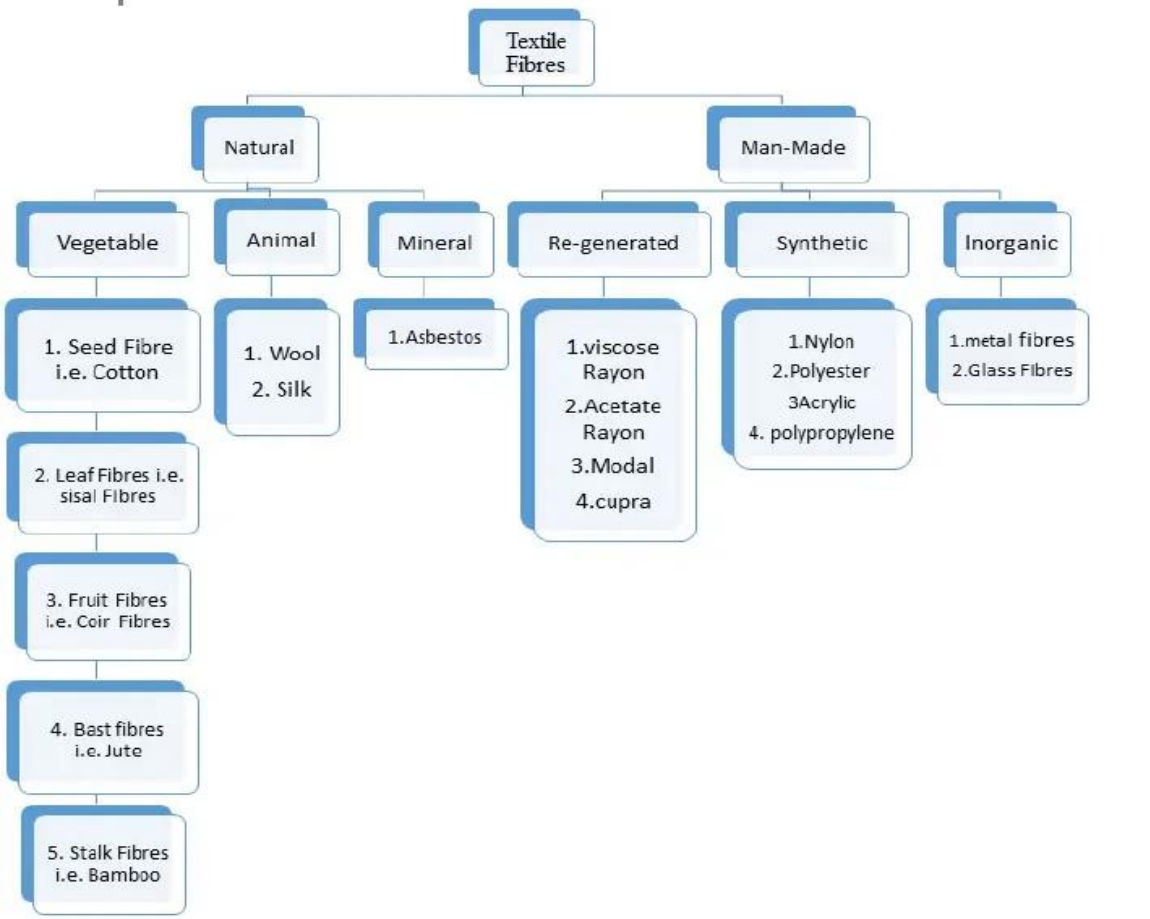
MOTIF-A decorative image or design, especially a repeated one forming a patternare images, ideas, sounds, or words that help to explain the central idea of a literary work .

EMBROIDERY-Method of decorating fabric with designs stitched in coloured thread or yarn.

ORNAMENTATION- ornamentation adds immense beauty and enhances the look of a garment. The main idea of fabric decoration is to add an element of interest. The most common materials used for surface ornamentation are mirrors, beads, sequins, threads, wires, buttons, etc. Surface ornamentation is a skill.

2 FIBRE CLASSIFICATION

Textile fibres can be defined as the textile substance that is very small in diameter in relation totheir length or in other words fibre is the material which is several hundred times longer than itsthickness. Fibre is the basic component of any textile material. There are different types of fibresaround us in daily use. Fibres with a short length are called as staple fibres, whereas fibres withlong length are called as filaments.



Types of Textile Fibres

1.Natural Fibres

2.Man-Made Fibres

Natural Fibres-Fibres which are obtained from the natural origin directly or indirectly referred as natural fibres.

Fibres obtained from the natural origin can be further sub-classified into three different categories based on their different natural origins. Classification of natural fibre is as follows –

1. Vegetable Fibres

2. Animal Fibres

3. Mineral Fibres

1.Vegetable Fibres-These fibres are basically cellulosic fibres. Besides their use as textiles, these fibres are also used in the manufacturing of papers. Vegetable fibres are basically obtained from various parts(Organs) of the plants such as seeds, bast, leaf, fruit, stalk, etc.

Seed fibres are obtained from seeds such as cotton, kapok, etc. the cotton fibres are widely used for the apparel purpose, medical uses, and other textile applications.

Leaf fibres are obtained from leaves of plants such as Palf, sisal, agave, etc. Leaf fibres are used for marine ropes and cement reinforcement.

Fruit fibres are obtained from the fruit of the plant such as coir fibre (coconut fruit). These fibres are mainly used for manufacturing doormats, carpets, etc.

Bast fibres are obtained from the bast surrounding to the stem of the plant. Such as jute, hemp, flax, ramie, etc. These fibres have more strength, durability and do not get affected by moisture so that they are used for manufacturing durable yarns, fabrics, packaging material and paper.

Stalk fibres are extracted from stalks of the plant – such as straws of rice, wheat, and other crops. Bamboo and grass fibre is also included.

1 **COTTON AND ITS PROPERTIES**

Cotton -Cotton fibers are natural hollow fibers; they are soft, cool, known as breathable fibers and absorbent. Cotton fibers can hold water 24–27 times their own weight. They are strong, dye absorbent and can stand up against abrasion wear and high temperature. In one word, cotton is comfortable. Since cotton wrinkles, mixing it with polyester or applying some permanent finish gives the proper properties to cotton garments. Cotton fibers are often blended with other fibers such as nylon, linen, wool, and polyester, to achieve the best properties of each fiber.

Cotton is the most important natural textile fiber, as well as cellulosic textile fiber, in the world, used to produce apparel, home furnishings, and industrial products. Worldwide about 40% of the fiber consumed in 2004 was cotton.Cotton fibers are seed hairs from plants of the order Malvales, family Malvaceae, tribe Gossypieae, and genus Gossypium. Botanically, there are four principal domesticated species of cotton of commercial importance: hirsutum, barbadense, aboreum, and herbaceum. Thirty-three species are currently recognized; however, all but these four are wild shrubs of no commercial value. Each one of the commercially important species contains many different varieties developed through breeding programs to produce cotton with continually improving properties (e.g., faster maturing, increased yields, and improved insect and disease resistance) and fibers with greater length, strength, and uniformity.

The cotton fibers used in textile commerce are the dried cell walls of formerly living cells. Botanically, cotton fibers are trichomes or seed coat hairs that differentiate from epidermal cells of the developing cottonseed. The cotton flower blooms only for one day and quickly becomes senescent thereafter. On the day of full bloom, or anthesis, the flower petals are pure white in most hirsutum varieties. By the day after anthesis, the petals turn bright pink in color and, usually by the second day after anthesis, the petals fall off the developing carpel (boll).

Growth

The wild cotton plant was domesticated in Asia, Africa, and South America nearly six thousand years ago. Ancient Egyptians made fine cloth at least four thousand years ago. Their hand-spun cotton was as fine as for today’s best. Today, cotton is grown on 77 million acres in over 80 countries – anywhere the growing seasons are long and hot. Cotton grows on bushes that are three to six feet high. Its flowers last for five to seven days.

The boll is a seedpod about the size of a golf ball. It begins to grow after the flowers drop off. Inside are 7 or 8 seeds, and attached to them are the cotton fibers. Each seed may have as many as twenty-thousand fibers – that’s as many as one hundred fifty thousand individual fibers in each boll!

Cotton is threatened by the boll weevil. It’s a beetle feeds on bolls and the blossoms. Each year the weevil causes around two hundred million dollars of damage to the cotton crop in the US alone. So cotton is treated with insecticides, often by airplanes.

Harvesting

Cotton was once harvested by hand, often by slave labor or tenant farmers. As recently as 1965, over a fourth of the U.S. cotton crop was picked by hand. Today, harvesting cotton is highly mechanized. Harvesting machines called strippers and pickers efficiently remove the cotton while leaving the plants undisturbed. Spindle harvester, also called a picker, has drums with spindles that pull the cotton from the boll in one or two rows at a time. Even a one-row mechanical picker can do the work formerly done by 40 hand pickers.

In stripper harvesting, the stripper moves along rows of plants, passing them between revolving rollers or brushes that pull off the cotton. Strippers also pull twigs and leaves with the cotton.

Cotton gins separate the fibers, called lint, from the seeds. After ginning, the cotton goes to the bale press that packs it into 480-pound bales about the size of a large refrigerator.

Classing Cotton

Cotton buyers judge cotton on the basis of samples cut from the bales. Skilled cotton classers grade or “class” the cotton according to standards established by the US Department of Agriculture such as cleanliness, the degree of whiteness, length of the fiber, and fiber strength.The classes pull a sample. They discard most of the cotton until just a pinch of well-aligned fibers remains. They measure the length of the fibers, referred to as staple fibers. Longer staple fibers are higher-grade cotton and are sold at higher prices. Long staples range from 1.1 inches to 1.4 inches long.

Properties & Uses

The fibers are sent to a textile mill where carding machines turn the fibers into cotton yarn. The yarns are woven into cloth that is comfortable and easy to wash but does wrinkle easily. Cotton fabric will shrink about 3% when washed unless pre-treated to resist shrinking.Cotton is prized for its comfort, easy care, and affordability and is ideal for clothing, bedding, towels, and furnishings.

Comfortable to wear

Natural, cellulosic fiber

Made from the cotton boll

Absorbs water and “breathes”

Slow to dry

Resists static electricity build-up

Wrinkles easily

Can withstand heat, detergents, and bleach

About 20% stronger when wet than dry

Will shrink unless treated

Can be damaged by mildew

Can be damaged by prolonged exposure to sunlight

Long staple cotton (such a Supima, Pima, Egyptian, and Sea Island) can be woven into smooth, almost silky fabrics.

2 JUTE FIBRES

Jute is known as golden fibre because of its golden color & it will bring a golden future for Bangladesh. In terms of usage, production and global consumption, jute is second

only to cotton. Once upon a time before liberation it was the main exporting goods and was sold in raw & finished goods. Jute is a bast fiber used for sacking, burlap, and twine as a backing material for tufted carpets.roperties of Jute Fibers

1- Physical Properties

Dimensional stability of jute: Average good.

Jute color: Jute fibers can be white, yellow, brown, gray or golden.

Jute fiber length: 150 to 300 cm.

Elongation: 1.7% at the break.

Flexibility: Bad.

Specific gravity: 1.48.

Jute strength: 3 to 5g / den.

Moisture regain: 13.75% (standard).

2- Chemical Properties

Alkali Effect: Diluted alkalis have no effect on jute fibers, but strong alkali at boiling causes a loss of strength.

Acid effect: A strong acid during boiling causes hydro cellulose leading to a loss of strength but dilute acid has no effect on jute fibers.

Bleaching effect: Jute fibers are not affected by the oxidizing and reducing agent.

Effect of organic solvent: Jute is a good resistant to organic solvent.

Sunlight Effect: As lignin is present in jute fibers, it may be damaged by sunlight.

Effect of microorganisms: Jute has resistance to microbiological attack.

Dye ability: Jute fibers have a good ability for basic dye.

2.Animal Fibres

The fibres are obtained from animals are called as animal fibres. The fires are mainly made up of protein molecules. The basic element of a protein molecule is carbon, nitrogen, hydrogen, oxygen.

Wool (Hair fibres obtained from the animals) & silk fibres are common examples of animal fibres.The fibres obtained from the sheep are referred as wool fibres, in the way the hair of the horse, camel, goat are also obtained as fibre. 90% of hair fibres are wool fibres used various applications.

Silk is very delicate filament. It is obtained from silkworms. Silk formation takes place by the secretion of proteinous molecules in liquid form through the glands of the silkworm, It is located on the head of the worm. This liquid proteinous material gets converted into the solid filament. During this secretion process, the worm forms cocoons from which silk is extracted. The sericulture of the silkworm is called as the rearing of the silkworm.The Fibres obtained from the feathers of the birds is called as avian fibres.

3.Mineral Fibres These are the inorganic materials shaped into fibres. Asbestos is the example of mineral fibre. These fibres are fireproof, resistance to acid so that these fibres mainly found in the industrial application.

Man-Made Fibres

As the name itself indicates these textile fibres are made by man to meet the particular requirements.The chemical composition, structure, and properties are significantly modified during the manufacturing process.

Depending on the raw material chosen for making these textile fibres – fibres can be further sub classified into 3 categories –

1. Regenerated Man-Made

2. Synthetic Fibres

3. In-Organic Fibres

1.Regenerated Synthetic-Regenerated synthetic textile fibres are also called as semi-synthetic fibres.These fibres are made up of naturally long chain polymer structure, which is modified and partially degraded by a chemical process to enable the polymerization reaction to form the fibres. Most of the semi-synthetic fibres are called cellulose regenerated fibres.Examples: Viscose rayon, modal, cupra (Rayon), bamboo viscose, tencell.The cellulose required comes fromvarious sources such as rayon from the tree wood, modal from the beech trees, seacell from seaweed.In the manufacturing process of these fibres, cellulose is fairly reduced to the pure viscose form and then foam and then foamed into the fibre form by extrusion through the spinnerets.

2.**Synthetic Fibre**-Synthetic fibres are manufactured from the petrochemicals.Examples – Polyester, nylon, acrylic, etc.These fibres are formed by the polymerization of monomers. Once the polymer is formed, it can be formed into a filament by converting that polymer into fluid form and then extruding the molten or dissolved polymer through narrow holes to give filaments. To form the fibre from molten polymer it gets passed through the spinneret.An alteration in structure, design and in other words – aspects of yarn can be done by altering the polymers used for it.These fibres are generally very strong, fine and durable with very low moisture absorbency property so that these fibres are also called as hydrophobic fibres.In-Organic FibreThese textile fibres are also called as metallic fibres.

Metallic fibres are drawn from the ductile metals such as copper, gold, silver and can be extruded or deposited from more brittles such as nickel, aluminum and iron. From stainless steel also fibres can be formed.These fibres are not that much widely used but these fibres have their special applications in technical textile.

1.NYLON-Nylon is a man-made synthetic fiber that is strong while very light in weight, properties that lead to a wide variety of uses, such as fabric, rope and luggage.This fiber was first introduced in the 1930s as an early substitute for silk; it eventually became the fiber of choice for women's stockings. Chemist Wallace H. Carothers of the Dupont Company was one of the lead players in the development of nylon fiber. Nylon is one of the most popular manmade fibers used in the United States.Nylon possesses

many properties that make it a very useful fiber in many applications. It is very strong and elastic; its also easy to wash, and can usually be washed with similar items and does not typically require specialty laundering arrangements. Nylon dries rather quickly and t retains its shape rather well after laundering, which ensures longevity of the garment. Nylon fiber is very responsive and resilient as well as relatively resistant to heat, UV rays and chemicals.

Uses of Nylon

One of the most common uses for nylon is in women's stockings or hosiery. It is also used as a material in dress socks, swimwear, shorts, track pants, active wear, windbreakers, draperies and bedspreads. Less frequently encountered uses include flak vests, parachutes, combat uniforms and life vests; the fiber is also often used in manufacturing umbrellas, luggage and the netting for bridal veils.

2.POLYESTER-hemically, polyester could be a polymer primarily composed of mixtures within the ester functional group. Most synthetic and a few plant-based polyester fibers are made of ethylene. Which could be a integral of petroleum which will even be derived from other sources.While some sorts of polyester are biodegradable, most of them aren’t, and polyester production and use contribute to pollution round the world. In some applications, polyester could also be the only constituent of apparel products. But it’s more common for polyester to be blended with cotton or another fiber. Use of polyester in clothing lessens production costs, but it also decreases the comfort ability of clothing.When blended with cotton, polyester improves the shrinkage, durability, and wrinkling profile of this widely-produced fiber. Polyester fabric is very proof against ecological conditions. Which makes it ideal for long-term use in outdoor applications.

Uses of polyester

Fabrics made from polyester thread or yarn is used expansively in apparel and home furnishing products. Those products from shirts and pants to jackets and hats, bed sheets, blankets, upholstery furniture and computer mouse mats.

Industrial polyester fibers, yarns and ropes are used in tyre strengthening process

Polyester fabrics used for conveyor belts, safety belts, coated fabrics and plastic supporting with high-energy absorption.

Polyester fiber is used as cushioning and padding material in pillows, quilts and upholstery stuffing.

Polyesters are also used to make bottles, films, oilcloth, sheeting, canoes, liquid crystal flaunts, holograms, filters, dielectric film for capacitors, film insulation for wire and insulating tapes.

Polyesters are widely used as a finish on first-class wood products such as guitars, pianos and automobile/ship interiors.

3. RAYON

Rayon is a man-made redeveloped cellulose fiber. Rayon is produced from naturally occurring polymers; it may be a really artificial fiber or completely a natural fiber…..Man-made redeveloped cellulose fiber Rayon is a semi-synthetic or artificial fiber. Rayon is recognized by the name viscose rayon and art silk in the textile industry.Rayon fibre is a synthetic textile material which is fully the collection of cellulose acquired from cotton linters or from the soft tissue of trees such as spruce. Rayon was introduced in the year 1900 approximately, since it has been used in several textile fields.

Very first rayon was called artificial silk because it is in filament form and somewhat resembles like silk material. However, this similarity is deceptive because the chemical composition of rayon is totally varied from the chemical composition of silk fibres.Rayon is very soft, cool comfortable and very good absorbent property but could not be able to protect body heat and used in humid steamy climatic conditions. Rayon fibre has the

same comfort property as natural fibres. Rayon can replicate the feel and texture of silk, cotton, linen and wool.Rayon can easily be dyed in variety of colors .Rayon has very lower elastic recovery of any fibre.Rayon typically has an elevated luster quality giving it a brilliant gloss

Uses of Rayon

Rayon fibres are used in apparel industry such as Aloha shirts, blouses, dresses, Jackets, Lingerie, scarves, suits, ties, hats and socks…,

Some rayon fibres are for filling in Zippo lighters, furnishings including bedspreads, bedsheets, blankets, window covers, upholstery and slipcovers..,

industrial purposes such as medical surgery products, non-woven items, tire cord and some other uses like diapers, towels, feminine hygiene products..,

4 ACRYLIC FIBRE

Acrylic is a synthetic man-made fiber which was created to mimic wool and it does bear some resemblance to it in softness.Some brand names for acrylic are Acrilan, Orlan, and Creslon. The fiber has a soft, smooth feel which is very similar to wool, and is lightweight. It is often used to create plush velvets, and dyes beautifully.

Acrylic fiber fabrics are made from a synthetic polymer called acrylonitrile. This type of fiber is produced by reacting certain petroleum or coal-based chemicals with a variety of monomers, which means that acrylic fabric is a fossil fuel-based fiber.

Since acrylic fabric is one of the least breathable forms of textiles in the world, it is desired in heat-retention applications. However, there are concerns that acrylic may be carcinogenic, so it may be prudent to avoid contacting this fiber with your skin.

Acrylic can be thought of as artificial wool. It is made from the unlikely combination of coal, air, water, oil and limestone. DuPont first made acrylic fibers in 1944 and began commercial production in 1950. It is spun by either dry spinning or wet spinning. In dry

spinning the dissolved polymers are extruded into warm air. The fibers solidify by evaporation. In wet spinning the polymer is dissolved and extruded into a bath and then dried. In some ways, acrylic imitates wool. It has wool's warmth and softness, but does not absorb water. Instead, acrylic wicks moisture to the surface where it evaporates.

Uses of Acrylic

Acrylic is used in knitted apparels such as fleece, socks, sportswear and sweaters. It is also used to create fake fur, craft yarns, upholstery fabric, carpet, luggage, awnings, and vehicle covers.

Ist is commonly used in athletic equipment, and it’s common to see tracksuits, hoodies, and athletic pants made from acrylic fabric.

3.COMPARATIVE ANALYSIS

1.Natural and synthetic Fibre

Natural fibres:Fibres produced by plants or animals are called natural fibres. Best examples of plant fibres are: linen and cotton. Examples of animal fibres are: wool and silk. They have natural color. Incase coloring is required then dying is very easy. Usually natural fabrics are comfortable to wear. It is environmental friendly. On burning it turns into ash. Limited use of these fibres when compared to synthetic fibres.

Synthetic fibres:Man made fibres created in laboratories are called synthetic fibres. Examples of synthetic fibres are acrylic, nylon and polyester. Colors can be added as per required. Coloring is difficult. Theses fabrics are not comfortable to wear when

compared to natural fibres. It is not environmental friendly because some fibres like polypropylene is harmful. On burning it melts and gives out chemical smell. These fibres are more durable than natural fibres.

To make you understand how natural and synthetic fibres are different from each other, here are the some of the major differences between natural and synthetic fibres:

Difference between Natural and Synthetic fibres

1. Natural fibers are made from nature, whereas synthetic fibers are entirely human-made.
2. The length of natural fibers is decided by nature. Conversely, the length of synthetic fibers is decided by man.
3. The number of molecules in natural fibers is controlled by nature. On the flip side, the number of molecules in synthetic fibers is controlled by man.
4. Natural fibers have an unlimited number of molecules. On the other hand, synthetic fibers have a limited number of molecules.
5. Natural fibers are nature dependent. In contrast, synthetic fibers are not dependent on nature.
6. Natural fibers can grow everywhere, whereas synthetic fibers cannot grow everywhere.
7. Natural fibers are found in staple or filament form, while synthetic fibers can be found in staple, filament, or cut length form.
8. The spinneret is not needed during the spinning process for natural fibers production. Conversely, the spinneret is used during the spinning process of synthetic fibers.

9. No spinning process is required for filament production in natural fibers. On the other hand, the spinning process is an essential requirement for filament production in synthetic fibers.
10. Natural fibers do not need chemical solutions for yarn production, whereas synthetic fibers need chemical solutions for yarn production.
11. Natural fibers are comfortable to wear and good for health. On the flip side, synthetic fibers are not comfortable to wear and also not good for health.
12. Natural fibers are easy to dye, whereas synthetic fibers are difficult to dye.
13. Natural fibers are environment friendly, while synthetic fibers are not environmental friendly.
14. Natural fibers are decomposable. Conversely, synthetic fibers are non-biodegradable.
15. Natural fibers are expensive. In contrast, synthetic fibers are cheap.

2 FIBRE ,FILAMENT AND YARN

Filament fibers refer to fibers of long continuous lengths, while staple fibers refer to those of shorter lengths, which are about a few inches long. Most natural fibers, such as cotton and wool, are staple fibers. Synthetic fibers, such as nylon and polyester, are considered filament fibers. The natural fiber silk is also a filament fiber, but when filament fibers are cut short, they are considered staple fibers.Filament fibers are measured in yards or meters. Silk, in filament form, is reeled from cocoons. Man-made fibers of a chemical composition, liquid nature are forced through spinnerets, hardened and produced into continuous filament strands of a determined length. When filament

fibers are planned to be cut into staple fibers, a large spinneret with many openings are used. The filament fibers are grouped into a bundle referred to as a tow and then cut into the desired staple length. Line or low man-made fibers are manufactured in continuous strands of any desired length. The tows may be cut into staple lengths or flocks based on specific end use.

Staple Fibers:

Any fiber with a practical, limited or finite length is called “Staple Fiber” These are small length fiber like cotton, wool, jute etc. it may be natural (Cotton) or man-made (Viscose rayon, Polyester).

The length of the fiber varies within a fiber of the same source and also between varieties obtained from different sources. Staple fibers are measured in inches or centimeters. Staple fibers include almost all natural fibers except silk. Silk is a natural filament fiber and may be cut up to form short staple fibers. Staple fibers must be spun or twisted together to make a long continuous strand of yarn. They may also be used in their staple form to produce non-woven or felted fabrics.A staple is the fiber of cotton, wool or ramie etc of no more than a few inches long.

A filament is usually a man-made fiber of indefinite length. All fabrics woven, knitted or crocheted are made from yarn. The size of yarn has usually related the weight of the fabric eg. heavy fabrics use thick yarns, for light fabrics fine yarn is used. ll fibers having a practically unlimited or infinite length are called filaments. Filament fibers are continuous (long) fiber. It may be natural like silk or synthetic like Nylon.All man-made fibers are filament fibers, but only one natural fiber is filament fiber that is silk. Filaments are of two types; mono-filament and multi-filament.

Yarn is made by twisting together of fibers to make a strong product for manufacture of fabrics**.**Yarns are the continuous, short and staple fibre strands made. These materials range in size and structure and form a suitable textile cloth for knitting, weaving or otherwise intertwining.

4.FABRIC QUALITY ANALYSIS

What is Fabric Testing?

Normally garment is produced from fabric. The fabric can be woven or knitted or knit fabric, solid color dyed, printed, check, or stripe that is finished fabric. Before making garments from those fabrics especially for large quantities. It should be kept in mind that the garment may be rejected by the buyer due to some quality problem of the fabric although the fabric may be brand new. To avoid such kinds of problems, fabrics have to test to identify their actual quality before making the garments and it is called fabrics testing.

Objects of Fabrics Testing:

The reasons for carrying out tests on fabrics are numerous and some common ones are pointed out below:

To check that the fabric conforms to fabric specification.

To note the effect of changes in structural details.

To note the effect of physical and chemical treatment, exposure to weather or laundering or washing, etc.

To obtain some identification of probable performance in use.

To investigate the causes of failure and customers complain.s

To help in designing a fabric for a specific purpose.

To study the interaction of fiber, yarn, and fabric properties.

Resistant to light fastness-Light fastness or color fastness to light is that the resistance of the dyes or pigments used for coloration to tinting or change in color to exposure in direct sunlight or any artificial light. Different end uses of cloth would require

different levels of fastness towards the sunshine.Dyeing fabric resistant to light fastness, refers to the fabric after dyeing in the long-term sunlight, under the fade.

The outcomes of fading are different for the same dyestuffs on different fibres. E.g. the fading of azo dyes on cellulosic fibers is oxidation, and fading on protein fibers is a reducing effect.

The resistance to light fastness of the dye is also related to its molecular structure. E.g. some metal complex dyes are resistant to high fastness, while insoluble azo dyes are resistant to light fastness.

The resistance to light fastness is also related to the dye concentration at the time of dyeing. Resistance to light fastness assessment is based on “blue standard” as the basis. The so-called “blue standard” refers to the use of the specified dye in a certain concentration of blue wool fabric. The general concentration is high resistance to light fastness with low concentration of sun fastness is relatively good. The exposure time required for the sun to fade under the prescribed conditions is roughly doubled.

Lightfastness is measured by Spectrophotometer

Friction or Rubbing fastness-Friction fastness is the ability to withstand discoloration due to friction between fibres of the same fabric.The friction fastness of the dyed fabric is divided into dry friction fastness and wet friction fastness.

Dry friction fastness is reflected in the dry cloth after the white cloth stains, wet friction fastness is reflected with the water content of 95% to 100% of the white cloth after the friction of the situation. Generally wet friction fastness is lower than dry friction fastness. The frictional fastness of the fabric depends on factors like the amount of the float and the combination of the dye and the fiber, the permeability of the dye, and so on. In reactive dyes and fibers that are covalently bonded, dry friction fastness is very good.

The higher the dyeing concentration is, the lower the friction fastness is. Friction fastness test carried out on a Crock meter

Washing Color Fastness- Color fastness refers to the resistance of color to fade or bleed of a dyed or printed textile materials to various types of influences e.g. water, light, rubbing, washing, perspiration etc. It is an important indicator to measure the quality of dyeing products.

Due to the use of chemicals in the late processes of dyeing and finishing, like acid, alkali, oxidants, reductants, etc., and when using in washing, sunlight, rubbing, sweat, high temperature and so on, dyeing textiles may fade or discolor. Therefore, dye color fastness is diverse, including washing fastness, light fastness, rubbing fastness, perspiration fastness, chlorine fastness, ironing fastness, etc.

The color fastness requirement of textiles is different because of their different use and process. For example, the curtain which is less washed requires low Color Fastness, but due to exposure to the sun for a long time, it needs high lightfastness. Summer clothing fabrics should have higher light fastness, washing fastness and perspiration fastness for the reason that they always expose to sun and human body always sweats.It is measured by Lasundrometer

Fabric thickness is the most important variable determining the rate of heat transfer and hence the so-called ‘warmth’ of the fabric. Fabric thickness affects air permeability and moisture absorbency and also has a great influence on the abrasion resistance.Fabric thickness is defined as perpendicular distance through the fabric, which determines the dimension between the upper and lower side of the fabric. In order to determine the thickness of a compressible material such as textile fabric, the precise measurement of the distance between two parallel plates should be measured when they are separated by the cloth. A known arbitrary pressure between the plates should be applied and maintained.

It is useful to measure fabric thickness, in order to check the material against the specification.Fabric thickness is also useful in studying fabric properties such as thermal insulation, resilience, dimensional stability, fabric stiffness, abrasion and total handle value.

It is also useful when studying fabric geometry.

Determination of thickness of fabric samples in laboratory is usually carried out with the help of a precision thickness gaugeInstruments for measuring fabric thickness : **Reynolds and Branson thickness tester**.

In Fabric Thickness Gauge, the fabric whose thickness is to be determined is kept on a flat anvil and a circular pressure foot is pressed on to it from the top under a standard fixed load. Then the Dial Indicator directly gives the thickness in mm.

Fabric weight- Fabric weight is expressed as the weight of the fabric in grams per m2. It has no limits but does affect the many of the fabric properties.Fabric weight is a fundamental property that needs to be controlled during the manufacturing process in order to avoid economic loss, for example, by buying heavier fabric than is necessary for the product being manufactured. Fabric weight, that is, GSM, influences other fabric properties such as thickness, flexural rigidity, bending rigidity, drape, air permeability and thermal properties. For example, the lighter the fabric, the lower its bending rigidity.

This test can be carried out in different ways but it is very easy to know the weight of the fabric by cutting the fabric with the GSM cutter. Measure the GSM of the fabric by GSM cutter: .GSM means gram by square meter, and the weight of the textile which includes both knit, woven and non-woven is the designation, as the name implies. It’s a basic tool used to cut a tissue sample for the measurement of the gsm of the textile. The measurement of the fabric is 11.2 cm in diameter.

FABRIC STRENGTH-The strength of fabric or garment indicates its ability to resist mechanical damage due to the stress of normal wear and laundering. Fabric strength can be divided into three different areas i.e. resistance to tensile force, resistance to tearing force, and resistance to bursting force. In the case of woven fabric resistance to tensile force and tearing force is measured but in the case of knitted fabric resistance to bursting force is measured to assess the fabric strength.Bursting strength tester is used to determine fabric strength

FABRIC SHAPE-The dimensional stability of fabric refers to the change of fabric size when it is used or reprocessed due to the properties of a material and the potential thermal contraction force in the process of processing. The fabric with good dimensional stability is worn and washed for many times, the original pleating and shape are unchanged, and the dimensions don't shrink or elongated, which don't affect the user experience. The fabric with poor dimensional stability is usually shown as shrinkage, such as shrinkage in sewing, ironing, washing and so on. Among them, the wash shrink is the problem that consumer pays close attention to very much.

5. BASIC FABRIC PROPERTIES

1.COTTON

Appearance- When cotton is viewed under microscopic lens;

In longitudinal view, it appears as a flat tube with spiral twists or a twisted ribbon.

Under cross section view, it is bean shaped.

Colour- Color of cotton fiber is instrumental in fiber identification. The usual color of cotton fiber ranges from white to creamy white. The color of fiber depends upon the conditions under which cotton is produced e.g., time of picking, soil of growth, exposure of plant to sunlight, climatic conditions, impact of insects and fungi etc. The cotton produced normally has a cream white color. If fiber is not picked at the right time, it color may vary. If fiber is left for an extended period of time in the boll, it may turn bluish-white.There are five recognized groups of color: white, gray, spotted, tinged, and yellow stained. As the color of cotton deteriorates the process ability of the fibers decreases.

Luster-Cotton fiber has a very low luster naturally just like low elasticity

Shape-The width of cotton fibre is fairly uniform, varying between 12 and 20 μm wide. The cross-section of cotton fibre is generally referred to as being kidney-shape and some are elliptical.

Fiber Strength-Fiber strength is measured in grams per denier (gm/den). Cotton is a moderately strong fiber. It has a tenacity of 3.0 - 4.9 gm/den. The strength of cotton fiber is directly affected with the moisture regain and higher length. Wet cotton fiber is 20% stronger than dry cotton fiber. Similarly, long cotton fibers are stronger than short fibers.

Flexibility- Easy to fold and less flexible

Elastic Property-Elasticity of cotton fiber is very low. Recovery from deformation of cotton fiber from applied load is very low as cotton fiber is a rigid fiber and inelastic. At 2% extension, it has elastic recovery (ER) of 74%. At 5% extension, it has elastic recovery (ER) of 45%. Elastic property can be achieved by Chemical treatments for the purpose of improvement in crease recovery but fibers become harsher due to chemical treatment.Blending or mixing of cotton with elastic fiber, e.g. polyester.

Absorbancy-Cotton fiber has high absorbency power and this is why this fiber can be died properly and without any problem or difficulty. It absorbs perspiration

quickly which is its highly esteemed property. As the body perspires, cotton fibers absorb the moisture and release it on the surface of the fabric, so it evaporates.

Electrical Conductivity- Cotton is a very good conductor of heat and air. Cotton is a good conductorof electricity.

Dimensional stability-good

Effect of heat-Decomposes after prolonged exposure to temperatures of 150˚C or over.Burns readily.

Drapeability-The drape-ability of cotton fiber is quite good. You can use the cotton fiber made fabric in any kind of wear which needs more flexibility and drapes.

Stiffness- moderate to good

2.RAYON

Appearance - Striations seen in viscose and high-strength rayon

– If DE lustered, scattered specks of pigment can be seen.

Colour -white

Luster -Light to bright.High unless DE lustering pigment added

Shape-Manmade fibres can be manufactored in any length and diameters. In cross section the viscose rayon fibres appears as irregular circles with srerated (having a toothed edge) edges

Flexibility- moderate to good

Fibre Strength-Fair to excellent

– Regular rayon has fair strength

– High tenacity types have well to excellent strength

Elasticity- Regular rayon is low

– High strength rayon is good

Absorbancy-Regular rayon is low

– High strength rayon is good

Electrical conductivity- when viscose rayon quite dry, it is a good insulator but the moisture that it inevitably picks up considerably reduces its value for electrical uses. Viscose is not so liable to develop static charges in textile working as is cellulose acetate**.**

Dimension stability-It changes shape /dimension with abrasion and washings.

Effect of Heat-Loses strength above 300′ F

Decomposes between 350 and 400′ F

Drapeability- It drapes beautifully and is one of the most preferred wedding dress materials

Stiffness-poor

3. WOOL

Appearance - It is characterized by crimp and scales. Due to crimp, it is bulkier and wormer. Due to scale, it has differential friction which is not present in cotton. Due to scales and extensibility, its feeling property is good. Color varies depending n the types of wool.

Colour -The colour of wool fibre could be white,near white,brown and black.

Luster - Luster of course fibre is higher than fine fibre

Shape-The length of wool fiber varies from 2 inches to twelve-inch depending on the type of fiber and the interval length of time of collec

Flexibility- good flexibility

Fibre Strength-It is stronger than silk. When wet wool loses about 25% of its strength. Longer the fibre the greater will be the strength of the yarn.Wool is a weak fiber. Its tenacity varies from 1 to 15 g/dtex but very high extension at break which is 35%.

Elasticity- natural elasticity helps wool garments stretch with your body, yet return to their original shape. So fine wool clothing is ideal to wear when exercising.

Absorbancy- Wool is the most hygroscopic in nature. It can absorb up to 50% of its weight and carry up to 20% weight, without giving the feeling of being wet. Upon drying it losses moisture slowly preventing rapid evaporation thus avoiding chilling feel to the user. It absorbs perspiration after violent exercise and guards the body against the sudden change in temperature.

Electrical conductivity- Wool fiber is not a good conductor; therefore, the apparel or clothing made from these are considered to be the best for winter wear.

Dimension stability-poor to good

Effect of Heat- Low heat has no effect but strong heat weakens the fibre and destroys the colour of the fibre.

Drapeability-poor

Stiffness-Wool fibres are extremely fine, enabling them to bend and feel soft and gentle next to your skin.

4.SILK

Appearance - Cultivated degummed silk viewed lengthwise underneath a microscopic, resembles a swish clear rod underneath magnifier. Silk within the gum has rough irregular surface. Wild silk tend to be quite uneven and is a few what dark. it's going to have longitudinal striations.Single, smooth, nearly Triangular cross-section structureless, occasion- with rounded comers. with flattened fibre, variable in diameter. Degummed silk Flat irregular ribbons Very enlongated triangles separate,

Colour -The color of silk fiber could be yellow, brown, green or grey.

Luster - Bright.

Shape- Silk filaments square measure terribly fine and long. they regularly live regarding one thousand to 1300 yards long. The breadth of the silk is from nine to eleven microns.

Flexibility- poor to good

Fibre Strength- Cotton is a strong fiber. It has a tenacity of 3.5 - 5 gm/den. The strength is greatly affected by moisture; the wet strength of silk is 75 - 85%, which is higher than dry strength.

Elasticity- Not so good. it's associate elastic fibre and its physical property varies because it is fibre. Silk fibre could also be stretched from 1/7 to 1/5 its original length before breaking.

Absorbancy- Standard moisture regain is 11% but can absorb up to 35%.t has more absorbency than cotton. The moisture regain of silk is 11%. It absorbs moisture more quickly than cotton but it gets dried fairly quickly too.

Electrical conductivity- The silk is a poor conductor of electricity. it has a tendency to form static charge, when it is handled during different kinds of processes like weaving etc. This causes difficulties during processing in dry atmosphere.

Dimension stability-

Effect of Heat- Silk will withstand at higher temperatures than wool. It will remain unaffected for prolonged periods at 1400C. Silk decomposes at 1750C.

Drapeability- Silk fibre sows good flexibility. The silk fabric poses good drapping properties.

NYLON

Appearance -Very smooth and even

Colour - white

Luster - Bright to Light.High natural luster can be controlled

Shape

Flexibility- poor

Fibre Strength- Exceptionally high (60,000 – 108,000) pounds per square inch

Elasticity- Very good

Absorbancy- poor

Electrical conductivity- Low, generates static

Dimension stability-good

Effect of Heat- High resistance melts at 482′ F

Drapeability-poor

Stiffness- good

Color Fastness:

Color fastness is one of the important factors in case of buyers demand. The outstandingly important property of a dyed material is the fastness of the shade of color. Color fastness refers to the resistance of color to fade or bleed of a dyed or printed textile materials to various types of influences e.g. water, light, rubbing, washing, **perspiration** etc. to which they are normally exposed in textile manufacturing and in daily use. We have written a lot of articles on color fastness.

Factors Affecting the Color Fastness Properties:

1. The chemical nature of the fiber. For example, cellulosic fibers dyed with reactive or vat dyes will show good fastness properties. Protein fibers dyed with acid mordant and reactive dyes will achieve good fastness properties and so on. That is to say compatibility of dye with the fiber is very important.
2. The molecular structure (e.g.) of a dye molecule: If the dye molecule is larger in size, it will be tightly entrapped inside the inter-polymer chain space of a fiber. Thus the fastness will be better.
3. The manner in which the dye is bonded to the fiber or the physical form present.
4. The amount of dye present in the fiber i.e. depth of shade. A deep shade will be less fast than a pale or light shade.
5. The presence of other chemicals in the material.
6. The actual conditions prevailing during exposure.

You Can Read the Following Articles:

- **Color fastness to washing**
- **Color fastness to water**
- **Color fastness to rubbing/crocking**

- **Color fastness to perspiration**
- **Color fastness to light**
- **Color fastness to sea water**
- **Color fastness to chlorinated water**
- **Color fastness to hot pressing**

Color fastness to washing The resistance of a material to change in any of its color characteristics, when subjected to washing is called **color fasntess to washing**.

General Principle:

A specimen of the textile to be tested, with the adjacent fabric attached is subjected to washing under specified conditions. Te extent of any change in color and that of the staining of the adjacent fabric are assessed and the rating is expressed in fastness numbers.

There are two types of adjacent fabrics; (1) single **fiber** fabric and multiple fiber fabric. In the case of multi fiber fabric only one specimen is required and in the of single fiber fabric two adjacent fabric are required.
There are various colorfastness tests. Details of washing fastness tests are given below.

Fastness to Washing:

In the test, change in color of the textile and also staining of color on the adjacent fabric are assessed. A 10 x 4 cm swatch of the coloured fabric is taken and is sandwiched between two adjacent fabric and stitched, The sample and the adjacent fabric are washed together. Five different types of washing are specified as different washing methods.

Fig: Washing fastness testing by Gyrowash

Fastness to Wash

Sr.No	Method	Washing severity	Soap+Soda grams/liter	Time in minutes	Temperature in	Steel balls
1	IS:687:79	Very mild like hand wash	5	30	40+/- 2	Nil
2	IS:3361:79	5 times severe than method 1	5	45	50+/- 2	Nil
3	IS:764:79	Mild washing	5 + 2	30	60+/-2	Nil
4	IS:765:79	Severe washing	5 + 2	30	95+/-2	10
5	IS:3417:79	Severe washing	5 + 2	4 hrs	95+/-2	10

The solution for washing should be prepared to the required temperature of washing. The liquor material ratio is 50:1 . After soaping treatment, remove the specimen, rinse twice in cold water and then in running cold water under a tap. Squeeze it and air dry at a temperature not exceeding 60°C. The change in color and staining is evaluated with the help of grey scales.

Color fastness to rubbing/crocking

A fastness is a place, such as a castle, which is considered safe because it is difficult to reach or easy to defend against attack. This test is designed to determine the degree of color which may be transferred from the surface of a colored fabric to a specify test cloth for rubbing (which could be dry and Wet).

There are two test methods for rubbing fastness.

1. ISO-105-X12
2. AATCC-08

In ISO-105-X12 the wet pickup of the rubbing cloth is 100% .While in AATCC-08 the wet Pickup of the rubbing cloth is 65%.We check rubbing by Dry and Wet methods. In wet rubbing we wet the rubbing cloth according to test method and give rating by comparing the Staining with the gray scale.

Similarly for dry rubbing we check the rubbing with dry rubbing cloth and compare the staining With gray scale for ratings.Color Fastness to rubbing is a main test which is always required for every colored fabric either it is Printed or dyed.

If the **color fastness** to rubbing is good then its other properties like Washing fastness and durability etc improves automatically because the rubbing is a method to check the fixation of the color on the fabric. So if the fixation is good its washing properties will be good.

Rubbing Fastness depends on:

- Nature of the Color
- Depth of the Shade

Construction of the FabricNature of the color Each color either it is pigment ,**Reactive** ,**Disperse** or direct has its own fastness properties to rubbing. There are

some colors like black, Red ,Burgundy ,Navy blue which have poor Color fastness properties because of their chemical structure.
Like Black color is a carbon base color and the particle size of carbon is large than the other colors that's why its rubbing properties are poor. Similarly red and blue are in the same case. So to improve the color fastness we add more binder to improve the fastness properties of these colors. It doesn't mean that we can not achieve the best results with these colors. The required results can achieve but production cost will be increase. On the other hand the construction of the fabric also effects the fastness properties.

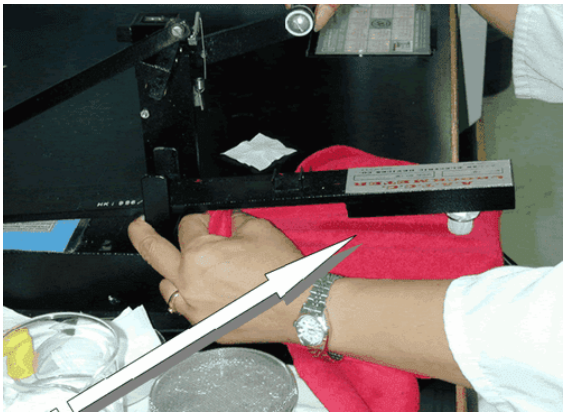


Fig: Rubbing fastness test

If the rubbing fastness on 100.80/40.40 is 3 on the gray scale it will be 2-3 on 52.52/22.22 with the same printing parameters. So always keep in mind these effects during finalize the required parameters with your customer .

Color Fastness Test to Light Fastness

The purpose of **Color fastness** to light test is to determine how much the color will fade when exposed to a known light source. It is an off line quality assurance system. Generally man wears the fabric and goes outside of the home for doing their job. In day; sun light fall on the fabric surface. So it needs to know how much protection ability have a fabric to sun light. It is determined by an experiment called **color fastness to light**. To measure the color fastness a blue scale is used. After completing the test, sample is compared with the blue scale.

Principle of Color Fastness to Light:

This test measures the resistance to fading of dyed textile when exposed to day light. The test sample is exposed to light for a certain time which is about 24 hours to 72 hours or by customer/buyer demand and compare the change with original unexposed sample the changes are assessed by Blue Scales.

Light Fastness Grades:

Grade	Degree of Fading	Light Fastness Type
8	No fading	Outstanding
7	Very slight fading	Excellent
6	Slight fading	Very good
5	Moderate fading	Good
4	Appreciable fading	Moderate
3	Significant fading	Fair
2	Extensive fading	Poor
1	Very extensive fading	Very poor

Color Fastness to Light with the Microsol light Fastness Tester:

The testing is done step by step. Following step is maintained during measure the color fatness to light.

- Cut the four pieces of test specimens according to the length & width wise and attached with the specimen holder.
- Then the holder set in to the Microsol light fastness tester.
- Then the experiment continued at 72 hours according to the buyer's requirement.
- After 72 hours later the specimen taken from the light fastness tester
- Then the test specimen compare with the Blue scale or **computer color matching system** (CCMS).