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Sample Material

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V-Skills

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1. TEXTILE

A textile or cloth is a flexible woven material consisting of a network of natural or artificial fibers often referred to as thread or yarn. Yarn is produced by spinning raw fibers of wool, flax, cotton, or other material to produce long strands. Textiles are formed by weaving, knitting, crocheting, knotting, or pressing fibers together (felt).

The words fabric and cloth are used in textile assembly trades (such as tailoring and dressmaking) as synonyms for textile. However, there are subtle differences in these terms in specialized usage. Textile refers to any material made of interlacing fibers. Fabric refers to any material made through weaving, knitting, spreading, crocheting, or bonding that may be used in production of further goods (garments, etc.). Cloth may be used synonymously with fabric but often refers to a finished piece of fabric used for a specific purpose (e.g., table cloth).

Textile design is the process of creating designs and structures for knitted, woven, non-wovenor embellishments of fabrics.

Knitting is a method by which thread or yarn is used to create a cloth.

Knitted fabric consists of a number of consecutive rows of loops, called stitches. As each row progresses, a new loop is pulled through an existing loop. The active stitches are held on a needle until another loop can be passed through them. This process eventually results in a fabric, often used for garments.

Knitting may be done by hand or by machine. There exist numerous styles and methods of hand knitting.

Different types of yarns and needles may be used to achieve a plethora of knitted materials; these tools give the final piece a different colour, texture, weight, and/or integrity. Other factors that affect the end result include the needle's shape, thickness and malleability, as well as the yarn's fiber type, texture and twist.

Weaving is a method of fabric production in which two distinct sets of yarns or threads are interlaced at right angles to form a fabric or cloth. The other methods are knitting, lace making, felting, and braiding or plaiting. The longitudinal threads are called the warp and the lateral threads are the weft or filling. (Weft or woof is an old English word meaning "that which is woven".) The method in which these threads are inter woven affects the characteristics of the cloth.

Cloth is usually woven on a loom, a device that holds the warp threads in place while filling threads are woven through them. A fabric band which meets this definition of cloth (warp threads with a weft thread winding between) can also be made using other methods, including tablet weaving, back-strap, or other techniques without looms.

The way the warp and filling threads interlace with each other is called the weave. The majority of woven products are created with one of three basic weaves: plain weave, satin weave, or twill. Woven cloth can be plain (in one colour or a simple pattern), or can be woven in decorative or artistic designs.

Textile designing involves producing patterns for cloth used in clothing, household textiles (such as towels) and decorative textiles such as carpets. The field encompasses the actual pattern making as well as supervising part or all of the production process. In other words, textile design is a process from the raw material into finished product. Fiber, yarn and finishes are the key elements to be considered during the textile design procedure.

Overview

Textile designing is a creative field that bridges fashion design, carpet manufacturing and any other cloth-related field. Textile design fulfills so many purposes in our lives. For example:

- ✓ People climb out from under sheets and blankets and step into slippers and a robe.
- ✓ People wash their faces with washcloths, dry them with towels, and put on clothing for the day.
- ✓ People sit on upholstered seats; the vehicle moves on tires reinforced with strong textile cord.

The above examples illustrate the importance of textile in our daily lives. Also, these examples give the idea to the textile designer to consider the contribution of the performance to the finished fabric, because the design from the designer gives a direct influence on the performance, durability and attractiveness of a final product. It embodies not only drawing skill but also business savvy of the global textile industry and consumer relations as well.

Textile designers marry a creative vision of what a finished textile will look like with a deep understanding of the technical aspects of production and the properties of fiber, yarn, and dyes.

Designs for both woven and printed textiles often begin with a drawing or watercolor sketch of the finished design. Traditionally, drawings of woven textile patterns were translated onto special forms of graph paper called point papers which were used by the weavers in setting up their looms.

In nowadays, designers might use software, hand paint, or grab a pencil and paper to record their design. Once a pattern is agreed upon, the design process shifts to choosing the proper fabrics and then to getting the design printed on or woven into the fabric. Designer might want to use the method of dyeing or printing to create their design. There are many printing methods. For instance,

- ✓ Direct (Blotch) Printing-It is a direct printing technique where the background color and the design are both printed onto a white fabric usually in a one operation. Any of the methods like block, roller or screen may be used
- ✓ Overprinting- Overprinting refers to the process of printing one colour on top of another in reprographics. This is closely linked to the reprographic technique of' trapping'. Another use of Overprinting is to create a rich black (often regarded as a colour that is "blacker than black") by Printing black over another dark colour

It is also the term used in the production of envelopes customized to order by printing images (such as logos) and texts (such as slogans) on mass-produced machine-made envelopes; the alternative way of producing such envelopes is to print "on the flat" and then cut out the individual shapes and fold them to form the envelopes. However the latter method is generally only economically viable for large print runs offering returns to scale.

Overprinting also refers to the printing of additional information onto self-adhesive labels and product packaging. “Best Before”, “Use By” dates and batch codes are printed in situ onto product packaging as the items are packed. Generally thermal printers, ink jet printers or laser printers are used.

Discharge Printing-Discharge printing, in which a bleaching agent is printed onto previously dyed fabrics to remove some or all of the color

- ✓ Resist Printing- . Resist dyeing, in which awaxor other substance is printed onto fabric which is subsequently dyed. The waxed areas do not accept the dye, leaving uncolored patterns against a colored ground
- ✓ Block Printing-Woodblock printing is a technique for printing text, images or patterns used widely throughout East Asia and originating in China in antiquity as a method of printing on textiles and later paper. As a method of printing on cloth, the earliest surviving examples from China date to before 220, and woodblock printing remained the most common East Asian method of printing books and other texts, as well as images, until the 19th century. Ukiyo-e is the best known type of Japanese woodblock art print. Most European uses of the technique for printing images on paper are covered by the art term woodcut, except for the block-books produced mainly in the 15th century.
- ✓ Roller Printing-This elegant and efficient process was patented and worked by Bell in 1785 only fifteen years after his application of the engraved plate to textiles. Bell's first patent was for a machine to print six colours at once, but, owing probably to its incomplete development, this was not immediately successful, although the principle of the method was shown to be practical by the printing of one colour with perfectly satisfactory results. The difficulty was to keep the six rollers, each carrying a portion of the pattern, in perfect register with each other. This defect was soon overcome by Adam Parkinson of Manchester, and in 1785, the year of its invention, Bells machine with Parkinson's improvement was successfully employed by Messrs Livesey, Hargreaves and Company of Bamber Bridge, Preston, for the printing of calico in from two to six colours at a single operation.

The advantages possessed by roller printing over other contemporary processes were three: firstly, its high productivity, 10,000 to 12,000 yards being commonly printed in one day of ten hours by a single colour machine; secondly, by its capacity of being applied to the reproduction of every style of design, ranging from the fine delicate lines of copperplate engraving and the small repeats and limited colours of the perrotine to the broadest effects of block printing and to patterns varying in repeat from I to 80 in.; and thirdly, the wonderful exactitude with which each portion of an elaborate multicolor pattern can be fitted into its proper place without faulty joints at its points of repetition.

- ✓ Screen Printing-Screen printing is a printing technique that uses a woven mesh to support an ink-blocking stencil to receive a desired image. The attached stencil forms open areas of mesh that transfer ink or other printable materials which can be pressed through the mesh as a sharp-edged image onto a substrate. A fill blade or squeegee is moved across the screen stencil, forcing or pumping ink into the mesh openings for transfer by capillary action during the squeegee stroke. Basically, it is the process of using a stencil to apply ink onto a substrate, whether it be t- shirts, posters, stickers, vinyl, wood, or other material.

Screen printing is also a stencil method of print making in which a design is imposed on a screen of polyester or other fine mesh, with blank areas coated with an impermeable substance. Ink is forced into the mesh openings by the fill blade or squeegee and onto the printing surface during the squeegee stroke. It is also known as silkscreen, serigraphy, and serigraph printing. One colour is printed at a time, so several screens can be used to produce a multicolored image or design.

Today, most professional textile designers use some form of computer-aided design software created expressly for this purpose.

Some of the latest advances in textile printing have been in the area of digital printing. The process is similar to the computer controlled paper printers used for office applications. In addition, heat-transfer printing is another popular printing method to be used in the textile design.

1.1. Etymology

The word “textile” is from Latin, from textiles, meaning “woven”, and textiles is from textus, the past participle of texere, or “to weave”.

Meanwhile, the word “fabric” also derives from Latin, most recently from the Middle French fabrique, or 'building, thing made', and earlier as the Latin fabrica 'workshop; an art, trade; a skillful production, structure, fabric', which is from the Latin faber, or 'artisan who works in hard materials, from PIE dhabh, meaning 'to fit together'.

The word 'cloth' derives from the Old English clað, meaning a cloth, woven or felted material to wrap around one, from Proto-Germanic kalithaz (compare O.Frisian 'klath', Middle Dutch'cleet', Dutch 'kleed', Middle High German 'kleit', and German 'kleid', all meaning "garment"). There are several different types of fabric from two main sources: manmade and natural. Inside natural, there are two others, plant and animal. Some examples of animal textiles are silk and wool. An example of plants is cotton.

1.2. History

The discovery of dyed flax fibers in a cave in the Republic of Georgia dated to 34,000 BCE suggests textile-like materials were made even in prehistoric times.

The production of textiles is a craft whose speed and scale of production has been altered almost beyond recognition by industrialization and the introduction of modern manufacturing techniques. However, for the main types of textiles, plain weave, twill, or satin weave, there is little difference between the ancient and modern methods.

Incas have been crafting quipus (or khipus) made of fibers either from a protein, such as spun and plied thread like wool or hair from came lids such as alpacas, llamas, and camels, or from a cellulose like cotton for thousands of years. Khipus are a series of knots along pieces of string. Until recently, they were thought to have been only a method of accounting, but new evidence discovered by Harvard professor Gary Urton indicates there may be more to the khipu than just numbers. Preservation of khipus found in museum and archive collections follow general textile preservation principles and practice.

During the 15th century, textiles were the largest single industry. Before the 15th century textiles were produced only in a few towns but during, they shifted into districts like East Anglia, and the Cots Wolds.

Uses

Textiles have an assortment of uses, the most common of which are for clothing and for containers such as bags and baskets. In the household they are used in carpeting, upholstered furnishings, window shades, towels, coverings for tables, beds, and other flat surfaces, and in art. In the workplace they are used in industrial and scientific processes such as filtering. Miscellaneous uses include flags, backpacks, tents, nets, handkerchiefs, cleaning rags, transportation devices such as balloons, kites, sails, and parachutes; textiles are also used to provide strengthening in composite materials such as fiberglass and industrial geo textiles. Using textiles, children can learn to sew and quilt and to make collages and toys.

Textiles used for industrial purposes, and chosen for characteristics other than their appearance, are commonly referred to as technical textiles. Technical textiles include textile structures for automotive applications, medical textiles (e.g. implants), geo textiles (reinforcement of embankments), agro textiles (textiles for crop protection), protective clothing (e.g. against heat and radiation for fire fighter clothing, against molten metal's for welders, stab protection, and bullet proof vests). In all these applications stringent performance requirements must be met. Woven of threads coated with zinc oxide nanowires, laboratory fabric has been shown capable of "self-powering nanosystems" using vibrations created by everyday actions like wind or body movements.

1.3. Textile Evolution

When early people realised they needed more than their own hair and skin to protect them from the weather, they looked around to see what was available. People lived in a cold climate, saw animals with skins that kept them warm. They hunted these animals for food and used the fur to cover their body.

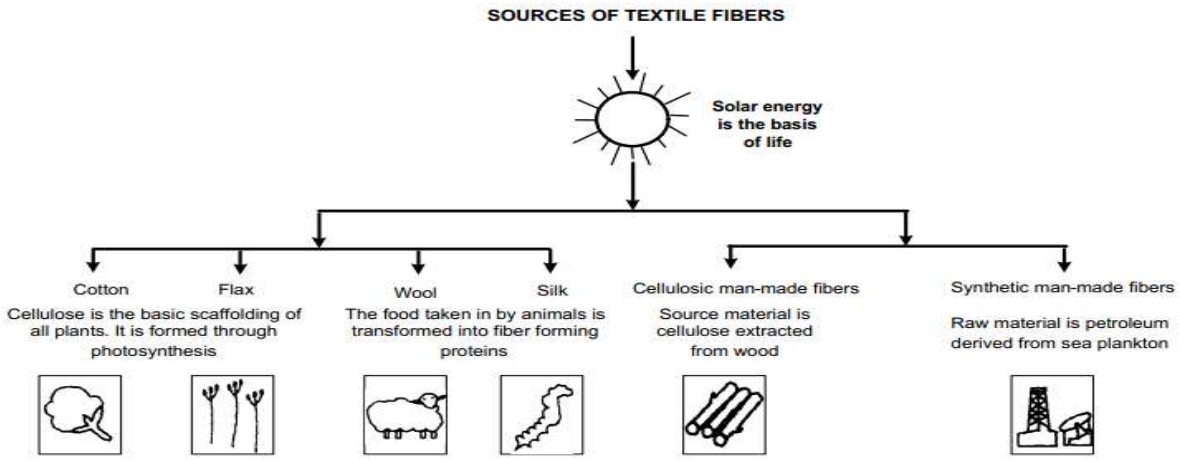
Once they started to hunt they used the skin of animals as clothes. This skin when continuously used becomes harder and made difficult for them to hunt. For this purpose they started to treat the skin to preserve its softness. Later the bones of animals were used as needle and nerves were used as thread to stitch the hides.

Ancient people used Grasses, reeds, leaves and stems to cover their body. They also learned to spin the fiber, convert it into yarn and these yarns are interlaced to form a cloth. Flax and wool were the first of the fiber to be used because they were easier to twist into yarn than cotton. They also used the hair of animals as bed, in due course, these hair tangled with each other and formed as a fabric. This method is only followed while making felt cloth.

People learned how to spin bits of plants, reeds, horse hair, and bark into one continuous strand, or yarn. Then they discovered how to take these long pieces of yarn and weave them into fabric, just like they wove the grasses. People began to look around for other fibers they could use to make yarn. The cotton, wool, silk, and flax that they found are still the most common natural fibers today. Other fibers, such as alpaca from llamas and angora from rabbits, were discovered, but, even today, these fibers are too scarce and expensive to be widely used. For thousands of years

the four natural fibers used by men are flax, wool, silk and cotton. Man made fibers was introduced only at the beginning of the 20th century. From ancient times to the middle of the 18th century Spinning and weaving were-done by hand.

Progress resulted in the industrial revolution, which was the start of the factory system and mass production. From ancient times colours have been used in fabrics. Dyestuff from plants and insects were used until the synthetic dyes were discovered. Cellulose formed through photosynthesis, is the basic scaffolding of all plants.



1.4. End Uses

Textiles are found in a hugely diverse range of products. Clothing us from birth until death, textiles protect us and make us feel good. Our homes are made more comfortable by textiles that keep in heat and by textiles that shield us from the sun. Keeping us warm at night, textiles also dry us when we are wet and can support injured limbs. Textiles allow us to make tea directly in a cup. More recently specialized textiles have been developed for medical use as artificial replacement ligaments and arteries, and geotextiles are used in the construction of dams and motorways and even bunkers on golf courses.

- ✓ Apparel textiles - The clothing or apparel market includes most garments that are worn. A huge consumer of fabric, clothing manufacture can be split by market, e.g. Men's, women's and children's clothing, sportswear, casual wear or formal wear. However, not all fabrics for garments are considered part of the apparel market. Fabrics such as the specialized protective clothing for fire-fighters, pilots and those in similar hazardous occupations are considered part of the industrial textiles market, and specialist clothing for leisure and ski wear, etc. are considered as being consumer textiles.
- ✓ Furnishing fabrics or interior textiles - The furnishing market is another huge consumer of textiles, for curtains, upholstery fabrics, carpets and wall coverings, either domestic or contract. Domestic furnishings are those found in the home, while contract furnishings are those used in offices and public buildings such as schools, hotels and hospitals.
- ✓ Household textiles - This category includes all textile products used within the home except furnishings, including sheets, pillowcases, towels, blankets, tablecloths, etc. When these products are used in the contract market they may be referred to as 'institutional fabrics'.

- ✓ Industrial textiles - Car tyres, medical textiles and geotextiles are all examples of industrial textiles. Industrial textiles also cover such textile products as filters, conveyor belts, car safety belts and parachute cords. Performance is of prime importance in this category.
- ✓ Consumer textiles - This category could be described as including any textiles not falling into the previous categories. Recreational items such as tents and back packs may be referred to as consumer textiles, as well as awnings and umbrellas and luggage. Although in this category performance can be very important, aesthetics can be equally so.

1.5. Fashion and Textile Designers

Fashion designers commonly rely on textile designs to set their fashion collections apart from others. Armani, the late Gianni Versace, and Emilio Pucci can be easily recognized by their signature print driven designs.

Sources and types

Textiles can be made from many materials. These materials come from four main sources: animal (wool, silk), plant (cotton, flax, jute), mineral (asbestos, glass fiber), and synthetic (nylon, polyester, acrylic). In the past, all textiles were made from natural fibers, including plant, animal, and mineral sources. In the 20th century, these were supplemented by artificial fibers made from petroleum.

Textiles are made in various strengths and degrees of durability, from the finest gossamer to the sturdiest canvas. The relative thickness of fibers in cloth is measured in deniers. Microfiber refers to fibers made of strands thinner than one denier.

Animal textiles Animal textiles are commonly made from hair, fur, skin or silk (in the silk worms case). Wool refers to the hair of the domestic goat or sheep, which is distinguished from other types of animal hair in that the individual strands are coated with scales and tightly crimped, and the wool as a whole is coated with a wax mixture known as lanolin (sometimes called wool grease), which is waterproof and dirt proof. Woollen refers to a bulkier yarn produced from carded, non-parallel fiber, while worsted refers to a finer yarn spun from longer fibers which have been combed to be parallel. Wool is commonly used for warm clothing. Cashmere, the hair of the Indian Cashmere goat, and mohair, the hair of the North African Angora goat, are types of wool known for their softness.

Other animal textiles which are made from hair or fur are alpaca wool, vicuña wool, llama wool, and camel hair, generally used in the production of coats, jackets, ponchos, blankets, and other warm coverings. Angora refers to the long, thick, soft hair of the Angora rabbit. Qiviut is the fine inner wool of the musk ox. Wadmal is a coarse cloth made of wool, produced in Scandinavia, mostly 1000~1500CE.

Silk is an animal textile made from the fibers of the cocoon of the Chinese silkworm which is spun into a smooth fabric prized for its softness. There are two main types of the silk: 'mulberry silk' produced by the Bombay Mori, and 'wild silk' such as Tussah silk. Silkworm larvae produce the first type if cultivated in habitats with fresh mulberry leaves for consumption, while Tussah silk is produced by silkworms feeding purely on oak leaves. Around four-fifths of the world's silk production consists of cultivated silk.

Plant textiles

Grass, rush, hemp, and sisal are all used in making rope. In the first two, the entire plant is used for this purpose, while in the last two; only fibers from the plant are utilized. Coir (coconut fiber) is used in making twine, and also in floor mats, doormats, brushes, mattresses, floor tiles, and sacking.

Straw and bamboo are both used to make hats. Straw, a dried form of grass, is also used for stuffing, as is kapok. Fibers from pulpwood trees, cotton, rice, hemp, and nettle are used in making paper.

Cotton, flax, jute, hemp, modal and even bamboo fiber are all used in clothing. Piña (pineapple fiber) and ramie are also fibers used in clothing, generally with a blend of other fibers such as cotton. Nettles have also been used to make a fiber and fabric very similar to hemp or flax. The use of milkweed stalk fiber has also been reported, but it tends to be somewhat weaker than other fibers like hemp or flax. Acetate is used to increase the shininess of certain fabrics such as silks, velvets, and taffetas.

Seaweed is used in the production of textiles: a water-soluble fiber known as alginate is produced and is used as a holding fiber; when the cloth is finished, the alginate is dissolved, leaving an open area.

Lyocell is a man-made fabric derived from wood pulp. It is often described as a man-made silk equivalent; it is a tough fabric that is often blended with other fabrics – cotton, for example. Fibers from the stalks of plants, such as hemp, flax, and nettles, are also known as 'bast' fibers.

Mineral textiles

Asbestos and basalt fiber are used for vinyl tiles, sheeting, and adhesives, “transite” panels and siding, acoustical ceilings, stage curtains, and fire blankets.

Glass fiber is used in the production of spacesuits, ironing board and mattress covers, ropes and cables, reinforcement fiber for composite materials, insect netting, flame-retardant and protective fabric, soundproof, fireproof, and insulating fibers.

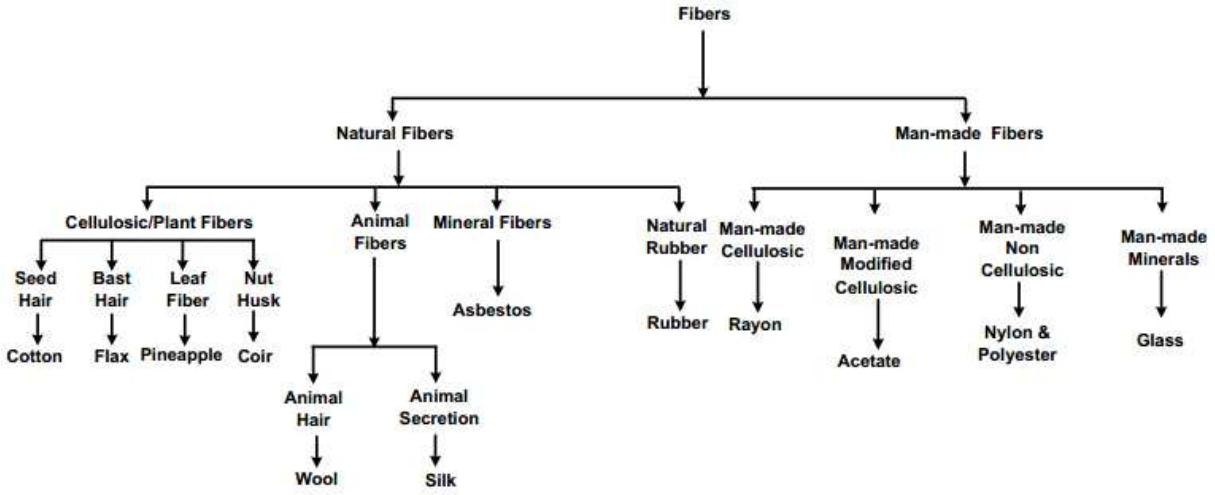
Metal fiber, metal foil, and metal wire have a variety of uses, including the production of cloth- of-gold and jewellery. Hardware cloth (US term only) is a coarse weave of steel wire, used in construction. It is much like standard window screening, but heavier and with a more open weave. It is sometimes used together with screening on the lower part of screen doors, to resist scratching by dogs.

Synthetic textiles

Embroidered skirts by the Alfaro-Nunez family of Cochas Peru, using traditional Peruvian embroidery methods. All synthetic textiles are used primarily in the production of clothing.

1.6. Fiber Classification and Properties

Fibres are the fundamental units used in fabrication of textile yarns and fabrics. It is an individual, fine, hair like substance. Fibers usually are grouped and Twisted together into a continuous stand called yarns. Fibers may be from natural sources or they may be man-made.



Natural Fibres

Plant fibers are composed of cellulose and therefore are classified as natural cellulosic bers. The important raw material to produce fabrics are fibers especially cotton and silk.

Cotton - The word cotton is derived from the Arabic word qoton or qutun, which means a plant found in conquered land. Cotton is fiber that grows from the surrounding surface of seeds in the pods, or balls of a bushy mallow plant. It is composed basically of a substance called cellulose. It's generic name is seed hair and common name is cotton.

Cotton is a member of the Mallow family. Its height ranges from 25 cm to over 2 m, depending upon variety, climate and agronomy. It is normally grown as an annual shrub. About 21 days after the buds are first seen, the cotton blossom appears. This is at first a creamy white to a deep yellow color. Later it becomes pink and eventually dark red. It lasts about 3 days, after which the petals fall off and the ovary ripens to form a pod which we know as the cotton ball. Next fibers push out from the coating of the seed, causing the ball to expand until it is nearly one inch in diameter and half again as long. Different varieties of cotton matures at different rates; usually it takes between 45 and 65 days from blossom to the open ball. The growing season, fertilizer, degree of cultivation and amount of moisture - all these factors may affect the maturing of cotton crops.

Properties of Cotton

- ✓ Lustre : Low
- ✓ Tenacity / Strength : Medium
- ✓ Elastic Recovery : Low
- ✓ Resiliency : low
- ✓ Dimensional Stability : Good.
- ✓ Acids : Damages, Weakens fiber
- ✓ Alkalies : Resistant (mercerization)

- ✓ Effect of sunlight : Weakens fiber slowly.
- ✓ Flame : Burns readily.
- ✓ Shape : Fairly uniform in width, 12 - 20 μ, length varies from ½ to 2 ½ inches.

Flax (Linen) - The word flax is derived from Old English "flax". Linen is the term applied to the yarn spun from flax fibres and to the cloth or fabric woven from this yarn, flax fibers are held together under the stem's bark principally by a gummy substance (pectin) from the body of flax plant. It is composed basically of substance cellulose. It is a natural, cellulosic, bast, multicellular fiber.

By the end of August, the flax turns a brownish color, which indicates that the plant is about to mature, it is ready for harvesting. There must be no delay at this stage; otherwise the fiber will lose its prized luster and soft texture. The plants are pulled out of the ground either by hand or efficiently by machine. If the stalk is cut, the sap is lost; this loss affects the quality of the fiber, the stalk must be kept intact and the tapered ends of the fiber must be preserved so that a smooth yarn may be spun. The stalks are tied in bundles, called beets in preparation for extraction of the fiber.

Properties of Linen

- ✓ Shape : Width varies. Diameter is varies from a few inches to 22 inches or more
- ✓ Luster : Medium to high
- ✓ Resiliency : Poor
- ✓ Moisture absorption : Good
- ✓ Dimensional Stability : Good
- ✓ Acids : Low or poor to hot dilute. Poor to concentrated either hot or cold
- ✓ Alkalies : High resistance.
- ✓ Sunlight : Good
- ✓ Insects : Good
- ✓ Flame : Burns readily

Silk - In old English, silk was sioloc. The name is thought to have originated from the Greek "Seres", meaning the people from Eastern Asia, namely the Chinese. Silk is very fine strand of fiber that is a solidified protein secretion produced by certain caterpillars to encase themselves in the form of cocoon. Sericulture, the production of the worms, their development and the spinning of cocoon is largely a home industry. The shorter waste fibers in the form of comber noils from spun silk processing are spun into coarser, irregular, neppy yarns using the woollen spinning system. Also known as Bourette Silk.

Degummed Cultivated Silk	Weighted Cultivated Silk	Wild Silk
Wrinkles little, fine luster fine and smooth Types: spun silk, noil silk	Full, heavy, wrinklesless, durable and has strong lustre	Coarser, heavier than cultivated silk, darker

Properties of silk

- ✓ Shape : The fiber is long from 1,000 to 1,300 years.
- ✓ Luster : High
- ✓ Elastic recovery : Good

- ✓ Elongation : Good
- ✓ Moisture absorption : Good
- ✓ Dimensional stability : Good
- ✓ Acids : Damage
- ✓ Alkalies : Strong alkalies damage fiber;
- ✓ Sunlight : Prolonged exposure causes fiber breakdown
- ✓ Insects : Destroyed by carpet beetles
- ✓ flame : Burns with a sputtering flame.

Wool - The word wool was wull in old English. Wool is the fiber from the fleece of domesticated sheep. To produce good quality of wool, sheep are prevented against disease by chemicals and are fed nutritional diets. Wool can be sheared from the living animal or pulled from the hide after the animal has been slaughtered for its meat or it is dead due to some disease or something. The sheared wool is called fleece or clip wool.

There are about 40 breeds of sheep and more than 200 which are crossbred. Wool producing sheep may be classified into four groupings according to the Wool Quality.

- ✓ Merino wool - Merino sheep produces best wool. It is found in Spain. The staple is relatively short. Ranging from 1 to 5 inches but the fiber is strong, fine and elastic and has good working properties. It has greatest amount of crimp and has maximum number of scales. Used for best wool clothing.
- ✓ Class-two wools - This variety is not less than a very good quality wool. Its fiber is 2 to 8 inches in length, has a large number of scales per inch and has good crimp. The fibers are strong, fine and elastic and have good working properties. Found in England, Scotland and Ireland.
- ✓ Class-three wools- The fibers are from 4 to 18 inches long and are coarsened have few scales and less crimp than merino and class-two wool. Smoother and more lustrous. Good enough for clothing. Originated in U.K.
- ✓ Class-four wools- This class refers to half-breeds. Fiber length ranges from 1 to 16 inches, coarse, hairlike have relatively few scales and little crimp and are smooth and lustrous. Mainly used for carpets, rugs and inexpensive low-grade clothing.

Classification by Fleece- Wool shorn from young lambs differs in quality from that of older sheep. Also, fleece differ according to whether they come from live or dead sheep, which necessitates standards for the classification of fleece.

- ✓ Lamb's wool- The first Fleece sheared from a lamb about six to eight months old is known as lamb's wool and or fleece
- ✓ or first clip wool. This wool is of very-very fine quality. The fibers are extremely soft.
- ✓ Hogget Wool- Wool from 12 to 14 month old sheep for the first time. The fiber is fine, soft, resilient and mature. Good strength and is used for warps.
- ✓ Pulled Wool- Wool from slaughtered animal and is of inferior quality as quality of wool is not as good and roots of fibers are generally damaged.
- ✓ Dead Wool- Wool from dead animal which is inferior in grade.
- ✓ Taglocks- The tom, ragged or discolored parts of a fleece are known as taglocks.
- ✓ Recycled wool- Old woolen stuff is broken to make woolen fibers and shred them to yarns again.

Properties of wool
- ✓ Shape : Length varies from 1½" to 15" has scales on its surface.
- ✓ Luster : Medium
- ✓ Elongation : Good
- ✓ Resiliency : Excellent
- ✓ Density : 1.30 – 1.32 g/ccm
- ✓ Moisture absorption : Good
- ✓ Dimensional stability : Subject to felting and relaxation shrinkage.
- ✓ Resistance to acids : Good
- ✓ Resistance to alkalies : Low; many alkalies destroy the fiber.
- ✓ Sunlight : Prolonged exposure deteriorates fiber
- ✓ Insects : Damaged by moths and carpet Beetles.
- ✓ Flame : Burns slowly when in direct flame, is considered to be self extinguishing.

Rayon - Rayon was the first fiber to be produced commercially. By the passage of time increasing number of new fibers came into existence. A generic name is the name of a family of fibers all having similar chemical composition. All man-made fiber spinning processes are based on three general steps, which are

- ✓ Preparing a viscous solution or syrup dope.
- ✓ Extruding this solution through spinneret to form a fiber.
- ✓ Solidifying the fiber by coagulation, evaporation or cooling.

Rayon is a man-made cellulosic fiber in which the starting material is wood pulp or cotton linters which is physically changed. During the early history of man-made fibers, the term rayon was used to indicate any type of manufactured fiber that was based on cellulose, but now it is called man-made cellulosic fiber. Rayon received its name in 1925, before that it had been called artificial silk but because of its cellulosic content, it greatly resembles cotton in its chemical properties. Also known as viscose / polynosic.

Properties of Rayon- -
- ✓ Shape - Controlled by manufacturer. Diameter varies from 12 to 40 microns.
- ✓ Luster - Vary from dull to bright.
- ✓ Elongation - 19-24%
- ✓ Elasticity - 82%
- ✓ Moisture - 10.7 to 16%
- ✓ Dimensional stability - Poor for all types of Rayon.
- ✓ Resistance to acids - Generally not good but under some conditions it is acceptable
- ✓ Alkalies - Generally not good but under some conditions it is acceptable.
- ✓ Sunlight - Average
- ✓ Insects - Silverfish damage all types of cellulosic fibers.
- ✓ Heat - Extended exposure will eventually degrade the fiber.

Acetate and Triacetate - Acetate, which is properly called cellulose acetate (chemically di-acetate or secondary acetate) was first made by Paul Schutzenberger in 1869. The first use of this substance was as a coating on cotton fabric or as a film similar to cellophane or plastic wrap. As a coating the

substance was applied to fabric used in early aeroplanes. Triacetate fibers were developed along with regular acetate. However, manufacture of triacetate into fiber form was delayed until safe solvents became available in sufficient quantity to make production economically profitable. Both Acetate and triacetate continue to be respected fibers for selected types of fabrics however their use has continued to decline over the years.

Properties of Acetate and Triacetate-

- ✓ Shape - Shape can be controlled by the manufacturer-therefore uniform in observed appearance.
- ✓ Luster - V ary from dull to bright.
- ✓ Elastic Recovery - Good
- ✓ Resiliency - Low (acetate) Good (Triacetate)
- ✓ Dimensional stability - Good (for both)
- ✓ Resistance to Acids - Both fibers have fair resistance to dilute acids and poor to
- ✓ concentrated acids.
- ✓ Alkalis - Good to dilute and both are destroyed in concentrated alkalis.
- ✓ Flame - Both fibers burn easily and quickly.

Nylon - Nylon was the first synthetic fiber. In 1928 the Dupont company decided to establish a fundamental research program. If anything was discovered it would be good for the company - a means of diversification. It was noticed that when a glass rod was taken out of one of the polyester stills the solution adhering to it stretched out into a solid filament. The filament could be stretched ever further and it did not go back to its original length. This stimulated the group to concentrate on textile fibers. The term nylon was chosen for the fiber and it was called the miracle fiber for several years. The first nylon was referred to as type 6,6. The numbers derive from the fact that each of the two chemicals used in making this type of nylon has six carbon atoms. Nylon type 6, 10 was developed at the same time and it is composed of one chemical with six carbon atoms per molecule and ten carbon atoms per molecule for the second chemical. Nylon 6, 6 was considered desirable for apparel and selected home furnishings; nylon 6, 10 was used in making brushes, and similar items. In many countries nylon is identified by term "Polyamide".

Properties of Nylon-

- ✓ Shape - Shape is controlled by the manufacturer, filaments are uniform and long.
- ✓ Luster - Bright to Dull
- ✓ Elastic Recovery - 100%
- ✓ Elongation - Good
- ✓ Resiliency - Good
- ✓ Density - 1.1 g / ccm
- ✓ Moisture absorption - 8%
- ✓ Dimensional stability - Excellent
- ✓ Acids - resistance is poor
- ✓ Alkalies - Good resistance
- ✓ Sun light - Generally affects
- ✓ Insects - Normally damages
- ✓ Flame - Self extinguishing

Polyester - Polyester is sometimes referred to as the "workhorse" fiber of the industry. The filament form of the fiber has been said to be the most versatile fiber and the staple form has been called the "big mixer" because it can be blended with so many other fibers, contributing its good properties to the blend without destroying the desirable properties of the other fiber. Its versatility in blending is one of the unique advantage of polyester. The polyester have probably undergone more research and development work than any other fiber. One of the important physical changes has been that of changing from the standard round shape to a trilobal cross-section that gives the fiber silk-like properties. A chemical modification, high tenacity staple, was developed for use in durable press fabrics. The strength of the polyester reinforces the cotton fibers, which are weakened by the finishing process.

Properties of Polyester-

- ✓ Shape - Controlled by Manufacturers.
- ✓ Luster - Controlled from semibright to dull.
- ✓ Elastic Recovery - Varies
- ✓ Elongation - Varies by type
- ✓ Resiliency - excellent
- ✓ Density - 1.38 g/cm
- ✓ Moisture absorption - very low
- ✓ Dimensional stability - Excellent
- ✓ Resistance to acids - Strong acids destroy fiber, weak acids have little or no effect.
- ✓ Alkalies - moderate
- ✓ Sunlight - resistance is excellent
- ✓ Insects - Excellent
- ✓ Flame - will burn, but slowly and melting fibers tend to drop off, preventing further burning.

Other man made textiles are as

- ✓ Aramid fibre (e.g. Twaron) is used for flame-retardant clothing, cut-protection, and armor.
- ✓ Acrylic is a fibre used to imitate wools, including cashmere, and used in replacement of them.
- ✓ Spandex (trade name Lycra) is a polyurethane product that can be made tight-fitting without impeding movement. It is used to make activewear, bras, and swimsuits.
- ✓ Olefin fibre is a fibre used in activewear, linings, and warm clothing. Olefins are hydrophobic, allowing them to dry quickly.
- ✓ Ingeo is a polylactide fibre blended with other fibres such as cotton and used in clothing. It is more hydrophilic than most other synthetics, allowing it to wick away perspiration.
- ✓ Lurex is a metallic fibre used in clothing embellishment.
- ✓ Milk proteins have also been used to create synthetic fabric. Milk or casein fibre cloth was developed during World War I in Germany, and further developed in Italy and America during the 1930s. Milk fibre fabric is not very durable and wrinkles easily, but has a pH similar to human skin and possesses anti-bacterial properties. It is marketed as a biodegradable, renewable synthetic fibre.
- ✓ Carbon fibre is mostly used in composite materials, together with resin, such as carbon fibre reinforced plastic. The fibres are made from polymer fibres through carbonization.

1.7. Production Methods

Weaving is a textile production method which involves interlacing a set of longer threads (called the warp) with a set of crossing threads (called the weft). This is done on a frame or machine known as a loom, of which there are a number of types. Some weaving is still done by hand, but the vast majority is mechanised.

Knitting and crocheting involve interlacing loops of yarn, which are formed either on a knitting needle or on a crochet hook, together in a line. The two processes are different in that knitting has several active loops at one time, on the knitting needle waiting to interlock with another loop, while crocheting never has more than one active loop on the needle.

Spread Tow is a production method where the yarn are spread into thin tapes, and then the tapes are woven as warp and weft. This method is mostly used for composite materials; Spread Tow Fabrics can be made in carbon, aramide, etc.

Braiding or plaiting involves twisting threads together into cloth. Knotting involves tying threads together and is used in making macrame. Lace is made by interlocking threads together independently, using a backing and any of the methods described above, to create a fine fabric with open holes in the work. Lace can be made by either hand or machine.

Carpets, rugs, velvet, velour, and velveteen are made by interlacing a secondary yarn through woven cloth, creating a tufted layer known as a nap or pile. Felting involves pressing a mat of fibres together, and working them together until they become tangled. A liquid, such as soapy water, is usually added to lubricate the fibres, and to open up the microscopic scales on strands of wool.

Nonwoven textiles are manufactured by the bonding of fibres to make fabric. Bonding may be thermal or mechanical, or adhesives can be used. Bark cloth is made by pounding bark until it is soft and flat.

1.8. Textile Treatments

Textiles are often dyed, with fabrics available in almost every colour. The dying process often requires several dozen gallons of water for each pound of clothing. Coloured designs in textiles can be created by weaving together fibres of different colours (tartan or Uzbek Ikat), adding coloured stitches to finished fabric (embroidery), creating patterns by resist dyeing methods, tying off areas of cloth and dyeing the rest (tie-dyeing), or drawing wax designs on cloth and dyeing in between them (batik), or using various printing processes on finished fabric. Woodblock printing, still used in India and elsewhere today, is the oldest of these dating back to at least 220 CE in China. Textiles are also sometimes bleached, making the textile pale or white.

Textiles are sometimes finished by chemical processes to change their characteristics. In the 19th century and early 20th century starching was commonly used to make clothing more resistant to stains and wrinkles. Since the 1990s, with advances in technologies such as permanent press process, finishing agents have been used to strengthen fabrics and make them wrinkle free. More recently, nanomaterials research has led to additional advancements, with companies such as Nano-Tex and NanoHorizons developing permanent treatments based on metallic nanoparticles

for making textiles more resistant to things such as water, stains, wrinkles, and pathogens such as bacteria and fungi.

More so today than ever before, textiles receive a range of treatments before they reach the end-user. From formaldehyde finishes (to improve crease-resistance) to biocidic finishes and from flame retardants to dyeing of many types of fabric, the possibilities are almost endless. However, many of these finishes may also have detrimental effects on the end user. A number of disperse, acid and reactive dyes (for example) have been shown to be allergenic to sensitive individuals. Further to this, specific dyes within this group have also been shown to induce purpuric contact dermatitis.

Although formaldehyde levels in clothing are unlikely to be at levels high enough to cause an allergic reaction, due to the presence of such a chemical, quality control and testing are of utmost importance. Flame retardants (mainly in the brominated form) are also of concern where the environment, and their potential toxicity, are concerned. Testing for these additives is possible at a number of commercial laboratories, it is also possible to have textiles tested for according to the Oeko-tex certification standard which contains limits levels for the use of certain chemicals in textiles products.

1.9. Digital Printing

Digital printing refers to methods of printing from a digital-based image directly to a variety of media. It usually refers to professional printing where small-run jobs from desktop publishing and other digital sources are printed using large-format and/or high-volume laser or inkjet printers. Digital printing has a higher cost per page than more traditional offset printing methods, but this price is usually offset by avoiding the cost of all the technical steps required to make printing plates. It also allows for on-demand printing, short turnaround time, and even a modification of the image (variable data) used for each impression. The savings in labor and the ever-increasing capability of digital presses means that digital printing is reaching the point where it can match or supersede offset printing technology's ability to produce larger print runs of several thousand sheets at a low price.

1.10. Digital Printing Methods

Fine art inkjet printing

Fine art digital inkjet printing is printing from a computer image file directly to an inkjet printer as a final output. It evolved from digital proofing technology from Kodak, 3M, and other major manufacturers, with artists and other printers trying to adapt these dedicated prepress proofing machines to fine-art printing. There was experimentation with many of these types of printers, the most notable being the IRIS printer, initially adapted to fine-art printing by programmer David Coons, and adopted for fine-art work by Graham Nash at his Nash Editions printing company in 1991. Initially, these printers were limited to glossy papers, but the IRIS Graphics printer allowed the use of a variety of papers that included traditional and non-traditional media. The IRIS printer was the standard for fine art digital printmaking for many years, and is still in use today, but has been superseded by large-format printers from other manufacturers such as Epson and HP that use fade-resistant, archival inks (pigment-based, as well as newer solvent- based inks), and archival substrates specifically designed for fine-art printing.

Substrates in fine art inkjet printmaking include traditional fine-art papers such as Rives BFK, Arches watercolor paper, treated and untreated canvas, experimental substrates (such as metal and plastic), and fabric.

For artists making reproductions of their original work, inkjet printing is more expensive on a per-print basis than the traditional four color offset lithography, but with inkjet printing the artist does not have to pay for the expensive printing-plate setup or the marketing and storage needed for large four-color offset print runs. Inkjet reproductions can be printed and sold individually in accordance with demand. Inkjet printing has the added advantage of allowing artists to take total control of the production of their images, including the final color correction and the substrates being used, with some artists owning and operating their own printers.

Digital inkjet printing also allows for the output of digital art of all types as finished pieces or as an element in a further art piece. Experimental artists often add texture or other media to the surface of a final print, or use it as part of a mixed-media work. Many terms for the process have been used over the years, including "dig graph" and “giclée”. Thousands of print shops and digital printmakers now offer services to painters, photographers, and digital artists around the world.

1.11. Digital Laser Exposure

Digital images are exposed onto true, light sensitive photographic paper with lasers and processed in photographic developers and fixers. These prints are true photographs and have continuous tone in the image detail. The archival quality of the print is as high as the manufacturer's rating for any given photo paper used. In large format prints, the greatest advantage is that, since no lens is used, there is no vegetating or detail distortion in the corners of the image.

Digital printing technology has grown significantly over the past few years with substantial developments in quality and sheet sizes.

Applications

Digital printing has many advantages over traditional methods. Some applications of note include:

- ✓ Desktop publishing – inexpensive home and office printing is only possible because of digital processes that bypass the need for printing plates
- ✓ Variable data printing – uses database-driven print files for the mass personalization of printed materials
- ✓ Fine art – archival digital printing methods include real photo paper exposure prints and giclée prints on watercolor paper using pigment based inks.
- ✓ Print on Demand – digital printing is used for personalized printing for example, children's books customized with a child's name, photo books (such as wedding photo books), or any other short run books of varying page quantities and binding techniques.
- ✓ Advertising – often used for outdoor banner advertising and event signage, in trade shows, in the retail sector at point of sale or point of purchase, and in personalized direct mail campaigns.
- ✓ Photos – digital printing has revolutionized photo printing in terms of the ability to retouch and color correct a photograph before printing.