UNIT 1

Classification and general properties of textile fibres

Structure

Learning Objectives

After studying the chapter you will be able to understand various terms associated with fibers.

- Classify the textile fibers.
- List out various general properties of textile fibres.
- Distinguish between the vegetable and synthetic fiber.

Unit Preview

This unit gives the information regarding definition of terms, staple and filament i.e. classification of textile fibres and general properties of textile fibres.

1.0 Introduction

The word textile is derived from the Latin term "texture" for woven fabrics. Thus by textiles we understand those objects which have been prepared by weaving. Textile have an important bearing on our daily lives and everyone

needs to know about textiles as we use them in some way or the other. To understand about textiles the study of textiles will help to a great extent when we buy textile materials this knowledge will prevent us from making mistakes and we will be able to purchase good quality materials.

There is a growing demand for textiles and clothing by people of all walks of life.

Yarns are produced by twisting or spinning of the textile fibres and in turn fabric is a structure produced by interlacing or interloping of the yarns..

There are certain terms which are used very often in the study of textiles that are to be understood first. Most of the fabrics we use for various purposes are woven that means they are constructed by interlacing sets of yarns that run along lengthwise and crosswise directions. Each yarn is made up of several fibres therefore it is essential to know or to define the terms like fibre yarns and fabrics.

A "fibre "is defined as any product capable of being woven or otherwise made into fabric. It is smallest visible unit of textile product. Afibre can be defined as a "pliable" hair like strand that is very small in diameter in relation to its length". Fibres are the fundamental units or the building blocks used in the making of textile yarns and fabrics.

Fibres are the fundamental units used in making of textile yarns and later on into fabric. Thus fibres are the essential components and basic units and are an essential components for making yarns. These fibres are of many types.

Definition of Yarns

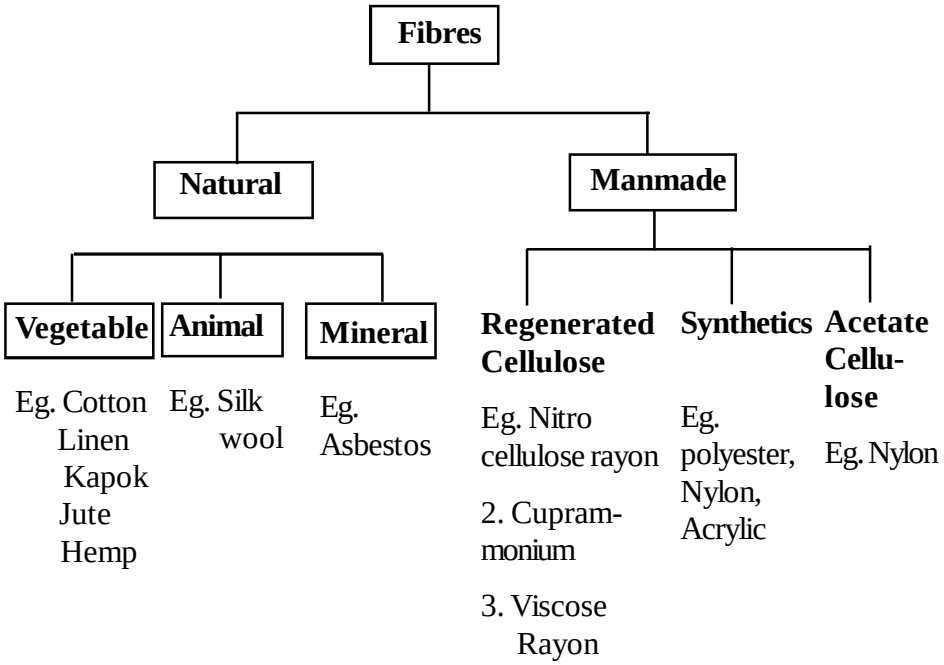
Fabrics made out of different fibres are available in the market. The common fibres that are used for fabrics are obtained from different sources. There are few fibres which are naturally available. Still some fibres are synthetised by using chemicals and are known as synthetic fibres eg. Nylon polyster and acrylic fibres.

Some fibres are manufactured by using raw material from nature and they are termed as man made fibres. Eg: Rayon, Polynosic, azlon etc.

1.1 Classification of textile fibres

Let us see how fibres are classified

According to the source from which textile fibres are obtained fibres are broadly classified into two ways.



Vegetable fibres or cellulosic fibres

The fibres that are derived from plants are called vegetable fibres. The basic material of all plant life is cellulose. Cellulose is made up of elements like carbon, hydrogen and oxygen. These cellulose fibres have certain common properties like low resilience, high density, and good conductor of heat. They are highly absorbent and are resistant to high temperature. Cotton flax, jute, ramie are some of the examples of vegetable fibres.

Animal fibres

The fibres which are obtained from animals are called animal fibres. Wool and silk are common examples of animal fibres. They are made up of protein molecules. The basic elements in the protein molecules are carbon, hydrogen, oxygen and nitrogen. Animal fibres have high resiliency but weak when wet because they are bad conductors of heat.

Mineral fibres

They are the inorganic materials shaped in to fibres and are mainly used in the fire proof fabrics. Asbestos is the example of mineral fibre. Mineral fibres are fire proof, resistant to acids and are used for industrial purposes.

Man made fibres

These refer to those fibres that are not naturally present in nature and are made artificially by man. Man made fibres have high strength, strong when wet low moisture absorption characteristics. Examples of man made fibres are viscose rayon, acetate rayon, nylon, polyester etc. Depending on raw material chosen for making of the fibres they are classified as cellulosic fibres, protein fibres and synthetic fibres.

1.2 General properties of textile fibres

1. Staple Fibres

Natural or man made or short length fibres which measures in inches or fraction of inch example 3/4 inch to 18 inches except silk all other natural fibres are staple fibres. Staple fibres are of limited length.

2. Filament

Long continuous fibres strands of indefinite length measured in yards or meters fibres of continuous length long enough to be used in fabric as such Natural silk filament is 360-1200 meters. Synthetic filaments can be made many kilometers long. The only natural fibre available is silk.

3. Texture

It is the tactile sensation experienced when hand is passed over a surface. Staple fibres and fabrics made from staple are lightly rough while filaments and fabrics made from filaments fibres are smooth..

4. Resilience

It means that when fibre is compressed and later when the pressure is released. It will tend to return to its original shape. Resistance to compression varies from fibre to fibre.

This quality causes the fabric to be wrinkle resistant with the resistance varying according to the degree of elasticity inherent in the fibre. Wool has outstanding resiliency while it is poor in cotton.

5. Luster

It is seen when light reflected from a surface. It is more subdued than shine. Silk and synthetics have luster than cellulosic fibres. Infact synthetics have high luster which is purposefully removed during spinning.

6. Static Electricity

It is generated by the friction of a fabric when it is rubbed against itself or other objects. If the electrical charge that is not conducted away, It tends to build up on the surface and when fabric comes in contact with a good conductor a shock or transfer occurs. This transfer may sometimes produce sparks. This is more feel during hot and humid conditions.

7. Crimp

Wool fibre is more or less wavy and has twists. This waviness is termed as **crimp**. Finer the wool more will be the crimps in it. Marino wool will have 30 crimps per inch while coarse wool has only one or two. This property of having crimps gives elasticity to the fibre.

8. Elasticity

It is the ability of stretched material to return immediately to its original size.

1.3 Difference between cellulose and synthetic fibres

Among natural fibres available cotton, wool and silk are the most commonly used fibres for making fabrics. Among artificial fibres rayon, nylon and polyester are popular. The following are the differences between vegetable fibres and synthetic fibres.

Difference between vegetable and synthetic fibre

S.No	Cellulosic fibres	Synthetic fibres
1.	Low resiliency: Fabric wrinkles unless any finishing is given	High resiliency: Less wrinkles after washing and wearing
2.	High water absorbency: Comfortable for summer wears, good for towel, hand kerchief and diapers.	Low moisture absorption: Easily washable and easy spot removing.
3.	Cellulosic fibres are good conductors of heat.eg: Cotton is a better conductor of heat but less than that of rayon.	Synthetic fibres are also good conductors of heat they melt with hot or ironic touch with hot objects.
4.	Identification: Cellulose fibres ignite quickly, burns freely with smoke and have an after glow and after burning	Identification: Readily burns and melts giving a distinct plastic burning odour.

	forms and a grey feathery ash.	
5.	Cellulosic fibres have high affinity for dyes.	Synthetic fibres have low affinity for dyes.
6.	Cellulosic fibres are resistant to moth but less susceptible to mildew hence damp clothes should not be stored.	Highly resistant to moths, mildew and insects.
7.	Cellulosic fibres need ironing at low temperatures.Eg: wool	Synthetic fibres are adjusted with high heat settings. Hence it is good for embossed designing and easy for plant setting.
8.	Susceptible to strong mineral and organic acids stains that require acid treatment should be rapidly removed.	Synthetic fibres get readily damaged due to acids.E.g.: Nylon

Polyester fibres burn readily and quickly with a chemical smell. It continues to burn after removing from flame and gives a plastic like in crushable bleed.

Conclusion

Fabrics are made out of different fibres are available in the market. The growth of the textile industry is largely the work of the professional personnel. New fibres new fabrics and new finishes make new demands for understanding the importance of the textile fabrics and their properties.

Test your understanding-I

State whether the following statements are true or false

1. Our primary needs are food, clothing and shelter (T / F)
2. Fibres are a pliable hair like structure (T / F)
3. Man made fibres are nylon and polyester (T / F)
4. Luster is the natural tendency to return their original condition (T / F)
5. Static electricity is generated by friction of a fabric (T / F)

Test your understanding-2

State whether the following statements are true or false

1. Waviness is terms as crimp (T / F)
2. Examples of natural fibres are polyester and nylon (T / F)
3. Cotton is a cellulosic fibre (T / F)
4. Wool fabrics gives warmth (T / F)
5. Nylon is first synthetic fibre invented in 1930 (T / F)

Short Answer Type Questions

1. What are fibres ?
2. What are the examples of vegetable fibres ?
3. What are animal fibres ?
4. What are mineral fibres ?
5. What are man-made fibres ?
6. What is filament ?
7. What is staple fibre ?
8. What is Resiliency ?
9. Define Luster and static electricity ?
10. Define Crimp ?

Long Answer Type Questions

1. Write the classification of textile fibres ?
2. What are the general properties of textile fibres ?
3. What are the differences between cellulosic and synthetic fibres ?

Answers to Test your understanding - I

1. True
2. True
3. True
4. False-resilience

5. True.

Answers to Test your understanding - II

1. True
2. False- synthetic fibres-polyster, nylon

   Natural fibres-cotton,wool, silk
3. True
4. True
5. True

UNIT 2

Manufacture and Properties of Cellulose Fibres - Cotton

Structure

Learning Objectives

After studying the chapter you will be able to:

- Understand the manufacturing of cotton by hand and by machine.
- Identify the structure and composition of fibre.
- Distinguish the various properties of cotton that is physical, thermal, chemical and biological properties.
- Various characteristics of cotton.
- Understand about cotton fibre blends.

• Know the consumer demand for cotton.

• Understand the major end use of cotton.

Unit Preview

This unit deals with the manufacturing process of cotton by hand and machine made, by products of cotton. The various properties such as physical, chemical and biological properteis of cotton, and various finishes for cotton.

2.0 Introduction

Cotton is obtained plant source and it is classified as a natural material as it is obtained from the seeds of cellulose seed fibre staple fibre measuring 10-65mm in length and white to beige in color in its natural state. It is composed basically of a substance called cellulose. As cotton occupies 50% of the consumption of fibres by weight in the world it is called as the king of all fibres.

Cotton is the fabric for every home and is the most widely produced of textile fabrics today. It has now been proved that India was the first country to manufacture cotton. Among the recent findings at Mohenjo-Daro were a few scrapes of cotton sticking to the side of a slivers vase. Cotton is the white downy covering of the seed grown in the pods. The cotton plant grown in the tropics needs a climate with 6 months of summer weather to blossom and produce pods.

Fig. 2.1 Cotton Boll

The cotton fibre is the shortest of all the textile fibres. Its length varies from 8/10 of an inch to 2 inches. Cotton with short length fibres is technically known as "short staple". The one with the long fibres is called "long staple" and it more used since it is used for making fine qualities of cloth. Long staple is especially suitable as it is easy to spin and produces a strong smooth yarn. It is also suitable for mercerization a finishing process used to improve the absorbency, strength and luster of fibre.

Cultivation of cotton

The principal cotton producing regions are Egypt, southern United States, India, Brazil the western and southern cost of America and East Indies. It requires 200 days to continue warm weather with adequate moisture and sunlight. Frost is harmful to the plant. March and April months are suitable for plantation.

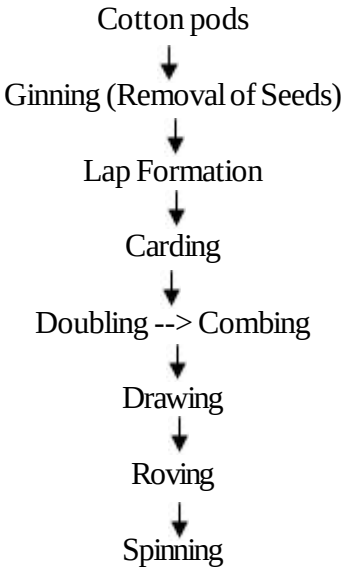
America produces more than 40% of the world's cotton. India ranks second to the United States as a producer and exporter of cotton.

2.1 Manufacture of hand made cotton in India

The tools and appliances used by cotton weaves consist of a spinning wheel (charkha) and a spindle (takli). The cotton is the first 'separated' and 'carded'. A bow shaped beater known as 'dhun' is used for the purpose. The string of the bow is placed on the cotton and is made to vibrate by means of a wooden hammer. These vibrations cleanses all foreign matter such as seeds and leaves leaving soft fine cotton behind. The fine cotton is rolled on stick to form a cylinder about half a cubit (6 inches) long and half an inch in diameter. This is tied to a spindle or takli. The charkha wheel is turned and the thin thread is gently drawn out until it is about 300 yards long and rolled on a charkha which is wound on to a bamboo reel. The yarn is sent to weaving unit where it is woven in to a cloth.

After weaving the cloth is calendared with a blunt beater to give it a gloss and to soften it. The cloth is then stamped, ticketed and made ready for sale.

2.2 Manufacture of Machine made cotton



Preparation: The fibres are first removed from seeds in a gin. This process is called ginning. Every bit of the cotton fibre is used in the manufacture . The fibre mass is then compressed into bales and shipped into spinning mills.

The short ends left on the seeds after the longer fabric. Fibres have been removed are used in the production of rayon, plastics, dynamite and many other by products, which are then used in the production of seed oil, hydrogenated fats, soaps and cosmetics.

Forming the laps: In the step dirt from cotton fibre is removed and fibres are made in to a soft roll or lap. Then several laps are combined into one.

Carding: These fibres are drawn together to form a loose rope called sliver.

Doubling: Slivers are combined here for uniformity.

Combing: This process is continuation and refinement of carding process. All cotton yarns for fabrics are carded but not all are combed. Yarns that are combed are finer even and free from all woody stalk of the plant. They are used for finer quality fabrics such as voile and organdie. Fabrics made from these fabrics are expensive too. The slivers are called carded slivers.

Drawing: The slivers is then combined, smoothened and stretched. The slivers may be drawn reduced further in size and given a slight twist by a process

called roving in which the slivers is passed through rollers and wound on to bobbins set into spindles. It is done in a speed frame.

Roving: The bobbins are placed on the roving frame where further drawing and twisting takes place until the cotton stock is about a pencil lead in diameter.

Spinning: Done on the spinning frame where the stock passes through sets of high speed rollers and gives the yarn of desired thickness.

Weaving and dying: The yarn is then knitted or woven in any one of the variety of weaves and structures. Warp yarns are usually more strongly twisted than filling yarns since they must withstand greater strain in weaving and finishing. Dye stuffs may be applied to raw cotton, yarn or piece goods.

Finishing: It includes starching,calendaring,sanforizing,mercerizing or other finishes as it is necessary for the particulars use for which the cloth is intended. These finishes may be applied to yarns but are usually applied to fabric. The fabrics may be given these special finishes before or after dyeing.

2.3 By products of cotton

Cotton linters: Linters are short, fuzzy fibres that remain on the seeds after they have been separated from the fibre in the cotton gin. They are used in the manufacturing of rayon and acetates, plastics and photographic film.

Fig. 2.2 Cross Section

Fig. 2.3 Cotton Fibre under the microscope

Hulls: These are outside portion of the cotton seeds rich in nitrogen and used as fertilizers, paper cattle feed.

Inner seed: It yields cotton seed oil which is used as cooking oils and in the manufacturing of soap.

2.4 Properties of cellulose fibre- cotton

1. Physical properties

a. Structure: The cotton fibre is short (1/2 inch -2 long inch) and cylindrical or tubular as it grows. The cotton fibre is essentially cellulose consisting of carbon, hydrogen and oxygen. Bleached cotton is almost pure cellulose raw cotton contains about 5% of impurities.

b**. Strength**: Cotton fibre is relatively strong which is due to the intricate structure and 70% crystalline.

c. Elasticity: Cotton is relatively inelastic because of its crystalline polymer system and for this reason cotton textile wrinkle and crease readily.

d. Hygroscopic moisture: Cotton does not hold moisture so well as wool or silk but absorbs it and so feels damp much more quickly. It also rapidly spreads throughout the material.

e. Electrical property: The hygroscopic nature ordinarily prevents cotton textile materials from developing static electricity.

f. Absorbency: As cotton has cellulose it is a good absorbent of fibre.

2. Thermal properties

Cotton fibres have the ability to conduct heat energy, minimizing any destructive heat accumulation thus they can withstand hot ironing temperature.

Drap ability: Cotton does not have good body to drape well in shape. The type of construction of the fabric may improve this property.

Resilience: Cotton wrinkles easily some wrinkle resistant finishes may reduce this property.

Cleanliness and wash ability: Though cotton absorbs dust due to its rough nature. It can be washed easily in the hot water and strong soaps without damaging the fibre.

Lustre: The natural cotton has no pronounced lustre. This can be improved by the mercerization finish of the cotton(that is sodium hydroxide treatment).

Shrinkage: The fibre itself does not shrink but cotton fibre which has been stretched in the finishing process tends to relax back creating shrinkage.

Heat conductivity: Cotton is the better conductor of heat than wool or silk but not as good as rayon.

3. Chemical properties

Action of acids and alkalies

Strong acids will destroy the fibres immediately. Dilute inorganic acids will weaken the fibre and if left dry will rot it. Therefore after treatment with acidic solutions cotton articles should be thoroughly rinsed in water. They are affected very little by organic acids. They are also quite resistant to alkalis even to strong caustic alkalies at high temperature and pressure.

In 8% NaOH cotton fibres swells, spirals, twisted uncoil and shrinks and become thicker. The resultant fibre is smoother, lustrous, and stronger and has increased water and dye absorption.

Effect of bleaching: These have no effects until used in uncontrolled conditions and with heat.

Effect of sunlight and weather: Ultraviolet rays of sunlight affect the strength of fibre and change the colour to yellow when exposed to prolonged period. Pollution also effect fibre.Concentrated and diluted mineral acids like sulphuric acids will discolour fibre .

Affinity to dyes: Cotton takes in dyes better than linen but not as readily as silk and wool. If a mordant is used cotton is easy enough to dye mordant colours, direct or substantive dyes should be applied to the cotton.

Effect of perspiration: Both acidic and alkaline perspiration discolours the fibre.

4. Biological properties

Resistance to micro organisms: The mildew and bacteria damages cotton.

Resistance to insects: Moths and beetles will not affect or damage the cotton. But the sliver fish eats the cotton cellulose.

2.5 Fabrics in cotton

Flannelette and flannel: A soft napped cotton fabric its warmth in wear is due to the fact that the nap traps a layer of air between the body and the cold outside. In composition it is the same as ordinary cotton, but treatment in weaving makes it very inflammable. For this reason attempts have been made to make it fireproof by saturating the fibre with metallic salt, but in general fire proofing does not withstand washing.

Organdie: A thin light fabric in plain weave with a very stiff finish. It is made from good quality combed yarn. The yarn is made from long staple cotton and is spun is with many twists. This along with the finishing process produces its characteristic transparent crispness. The aim is to give a permanent finish. The fabric is used for summer and evening wear.

Muslin: This is a cool, very light, and plain weave cloth also used for summer wear. The name derives from the city of Mosul where the fabric was first made muslins wear not always plain, silk and even gold stripes woven in when made in mosul but as cotton was grown more plentifully and the women could spin yarns of great fineness, cotton yarns gradually super seeded silk.

2.6 Finishes for cotton

The resin and the non resin finishes give the cotton some easy and minimum care features of as synthetics. Advances in anti bacterial mildew resistant and flame resistant treatments have improved the effectiveness of the performances of cotton in various end uses.

Regular finishes like singeing for smoothness mercerization for strength, lurtre and affinity for dyes, sizing and calendaring for lustre, maximum stiffness body and smoothness. Special finish like sanforizing for maximum pre shinking, crease resistant, anti bacterial finishes, mildew and rot treatment napping for softness, warmth, absorbency and moth repellent treatment are common.

Fibre blends

Among the various types of blends available in market today polyster, cotton terycotton, silk, linen cotton, viscose rayon and cotton and nylon.

Reasons of blending are:

To facilitate processing.

- To improve properties like dimensional stability.

- To produce better performance.

- To improve textute, hand or feel appearanceof fabrics.

- To produce multi color fabrics.

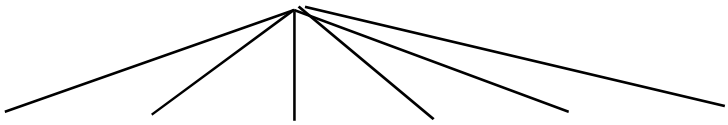
- To reduce cost.

2.7 Consumer demand for cotton

Versatality: Cotton can serve for food (cotton seed products) for clothing and for shelter. Cotton fibre can be spun alone or it can be blended with other

textile fibres such as linen, wool, silk, viscose rayon, polyster, nylon. It serves the purpose of clothing or apparel, home furnishing and industrial fabrics by giving comfort, durability, fashion and ease for care etc.

Consumer Demand for Cotton



Versatality Economy Durability Comfort Fashion Ease of Care

Durability: Due to natural twist cotton spins so well that it can be twisted very tightly. Hence tightly twisted yarns produce durable fabrics.

Comfort: Cotton conducts heat away from the body and allows the cooler temperature outside to reach the body, so it is a cool material for summer or tropical wear. Knitted cotton is used as comfortable wear.

Fashion rightness: Fashion designers of various countries have considered cotton glamorous enough to include in their collections.

Ease of care: The factors of light, laundering, ironing and perspiration are common consideration in color fastness to cotton.

Economy or price: Cotton materials are flexible to fit into all types of economic group. By products of cotton are used for many purposes.

Major end uses

Cotton is used for home furnishing : Towels are most common as it is high in absorbency, wide range of colors, washability and durability. Sheets and pillow cases are mostly blends of cotton with polyester or made of pure cotton. Drapes, curtains and upholstery fabrics are made of cotton and its blends.

Since cotton can be autoclaved at high temperatures, absorbency, washability and low static build up are important factors for use of cotton in hospitals.

Industrial uses include book bindings, luggages, and hand bags, shoes and, slippers, tobacco cloth, woven wiping cloths as and wall covering fabrics.

Wide range of wearing apparels: blouses, shirts, dresses, children wear, active wear, separates swimwear, suits, jackets, skirts, pants, sweaters, hosiery, bedspreads, comforters, throws, sheets, towels, table cloths, table mats, napkins.

Conclusion

Cotton continues to be the world's major textile fibre despite of many synthetics. It is the oldest and most versatile of all fibres with good properties when blended with other fabrics. The main reason for use of cotton is its good weaving qualities, low cost, high absorption, excellent, abrasion, stability to repeated blending. It can be safely ironed even at high temperature of 425 degrees F. It has excellent wash and wear and wrinkle resistance and also good if resin treated.

I. Test your understandings

State whether the following statement are true or false

1. Cotton does not have color retention property. (T / F)
2. Cotton cannot be blended with other fibres. (T / F)
3. Cotton conducts heat away from the body. (T / F)
4. Cotton is used for home furnishings. (T / F)
5. Cotton is moth repellent and provides softness and warmth. (T / F)

II. Test your understanding

State whether the statements are true or false

1. Cotton is natural fibre. (T / F)
2. The cotton with short length fibre is called as short staple. (T / F)
3. Hulls are inside portion of cotton seeds. (T / F)
4. Cotton is not good absorbent. (T / F)
5. Cotton is a good conductor of heat. (T / F)

Short Answer Type Questions

1. What is staple?
2. Give the steps for recent advances in handmade sector?
3. What are the by products of cotton?
4. What are physical properties of cotton?
5. What are the uses of cotton?
6. What are the reasons for fibre blends in cotton?

Long Answer Type Questions

1. What are the chemical properties of cotton?
2. What are the steps involved in preparation of machine made cotton?
3. Write short notes on following

   (a) Kapok (b) Flannelette and flannel (c) Organdie
4. What are the characteristics of cotton?
6. Write the consumer demand for cotton?

Answers for text your understandings - I

1. False
2. False
3. True
4. True
5. True.

Answers for text your understandings - II

1. True
2. True
3. False-outside
4. False-due to cellulose fibre it is good absorbent.
5. True.

UNIT 3

Manufacture and Properties of Protein Fibres

Structure

3.0 Introduction

3.1 History of silk

3.2 Production of silk

3.3 History of wool

3.4 Manufacturing of wool

Learning Objectives

After studying this unit, you will be able to

- Understand the various types of silk.
- Explain the manufacture of silk
- Describe the physical and chemical properties of silk
- Explain the classification of wool
- Understand manufacturing process of wool.
- Explain the physical and chemical properties of wool.

Unit Preview

This unit gives us the information regarding the manufacture of physical and chemical properties of protein fibres.

(1) Silk (2) Wool

3.0 Introduction

Silk is considered as "Queen of all textile fibres" as it has beauty and elegance and good properties of performance. Silk is the natural protein fiber obtained from silk worm cocoons. Japan is known for producing best variety of silk. India produces different varieties of silk and is famous for hand woven silk textiles. There is a tremendous silk production increase in recent years. The production of silk is called Sericulture. To obtain quality and quantity of silk rearing conditions are controlled carefully throughout the life cycle of silk moth.

These are two types of silk mulberry or cultivated silk and wild silk. Cultivated silk is creamy silk white or yellowish white in color. White wild silk color range from brownish to golden yellow in color.

3.1 History of silk

Sericulture or silk production has a long and colorful history unknown to most people. For centuries the west knew very little about silk and people who made it pliny, the roman historian wrote in his natural history in 70 BC "silk was obtained by removing the down from leaves with the help of water". For more than 2000 years these Chinese kept the secret of silk altogether to themselves. According to legend the beginning of history of use of silk as textile fibre goes back to 260 BC. When fourteen year old wife of Chinese emperor Huang-Ti discovered the secret of drawing the filament from cocoon of the silk worm and producing a fabric from the filament. This young princess Si-ling-chi is known as 'godess of silk worms' and is the centre of religious ceremonies connected with the care of silk worms and the production of silk has long been an important factor in economy of empire.

Silk has never lost its luxury field appeal and today is shown by all houses in their top fashion products some designers are working only on silk. It is everywhere in fashion picture. In intimate wear and outer wear, hand bags and shoes.

3.2 Production of Silk

Silk worms feed on mulberry tree leaves and therefore for rearing them, the growing of mulberry trees is the first essential step. These are grown by the agriculturists.

Silk worms have a short life of only about two months and during which these pass through the following four stages1. Egg 2.worm or larvae 3. Pupa and 4. moths.

Fig. 3.1Silk moth and eggs

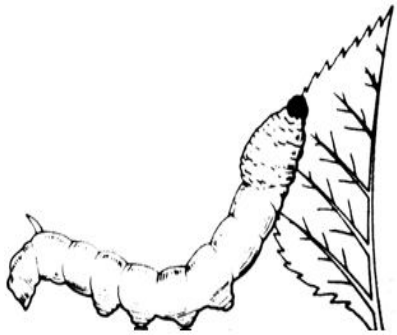


Fig. 3.2 Larva of Italian Bombyx mori silkworm moth

Fig. 3.3 Cocoon of Bombyx mori

Fig. 3.4 Male Bombyx mori or mulberry-feeding silk worm moth

Silk worms are made to lay eggs on specially prepared paper for this purpose. The eggs can be stored in cold storage for six weeks. Eggs are collected and kept at low temperature until they are hatched. Eggs take ten days to hatch Emerged caterpillars of ant head size are fed on fresh mulberry leaves. At this stage the worm needs special care bamboo trays with straw mats are provided for them. When the caterpillar is about eight weeks old it secretes a viscous fluid from two glands on its head which oozes out from the common opening near its mouth. The fluid is called 'fibrion'.At the same time it also secretes a gummy kind of fluid called 'sericin' which passes through the same opening. The fibroin gets hardened when exposed to air. The silk worm spins around itself to form a cocoon. The cocoon contains 2000 to 4000 yards of reelable silk. For separating the silk thread from the cocoons they are immersed in hot water. This immersion also kills the warm inside. Then the cocoons are dries and stored.

Reeling: The process of unwinding the filament from the cocoon is called reeling. The care and skill in the reeling operation prevents defects in the raw silk. As the filament of single cocoon is too fine for commercial use, three to ten strands are usually reeled at a time to produce the desired diameter of raw silk thread. Several cocoons are placed in hot water to soften the gum and the surfaces are brushed lightly to find the ends the filaments. These ends are collected, threaded through a guide and wound on to a wheel called 'reel'.

Throwing: As the fibres are combined and pulled on to the reel, twist can be inserted to hold the filaments together. This is called as throwing and the resulting yarn is 'thrown yarn'. This yarn later goes to weaving or knitting industry based the type of yarn produced.

Spinning: Short ends of silk fibres from the outer and inner edges of the cocoons and from broken cocoons and spun into yarns in a manner similar to that used for cotton. This is called spun silk.

Degumming: Sericin or gum up to 30% of the weight of the silk fibre. It is not usually removed until after the cloth is woven because serves as warp sizing that protects the yarns from mechanical injury during weaving. Sericin remains on the fibre during reeling and throwing before finishing, the gum is removed by boiling the fabric in soap and water. The presence of gum and sericin increases the tendency for the silk to water spots on fabrics when ironed.

Bleaching: Silk thread is treated with hydrogen peroxide.

Dyeing: Silk has great affinity for the dyes. Acid dyes produce brilliant shades on silk.

Printing: Silk may be left plain or may be printed by any method like roller printing, Screen printing or block printing. Silks are usually dried and then printed.

Finishing: Silk fabrics require very few finishes because they have natural lustre, softness and drapability.

Weighting of silk: When silk is boiled to remove the excess of natural gum or sericin it looses weight. This loss of weight is replaced through treatment by metals like tin, aluminium etc in water solutions. These are not removed by washing.

Weighted silk is not durable because sunlight and perspiration weakens fibres. Heavy weighting causes silk to crack.

3.2.1 Various types of silk

Wild silk: Silk produced by moths of species other than bombyx mori. It is brown in color more uneven and coarser. It is usually called Tussar silk.

Waste silk or silk noil: Short ends of spun yarns or in blends with cotton or wool. Sometimes it is called waste silk.

Dupion: Silk yarns made from two cocoons that have been formed in an interlocked manner. The yarn is uneven, irregular and large than regular filaments. It is used in making shantung and duppioni.

Raw silk: Silk that has not had any degumming.

Spun silk: Yarns made from short fibres from pierced cocoons and short ends and outside and inside the edges of cocoons.

3.2.2 Properties of silk

Microscopic structure

Silk has its unique properties. It is soft, supple, strong lighter in weight than any other natural fibre. Silk is priced for its weight. Silk is a natural protein fibre where the protein fibroin is held by a gummy substance .

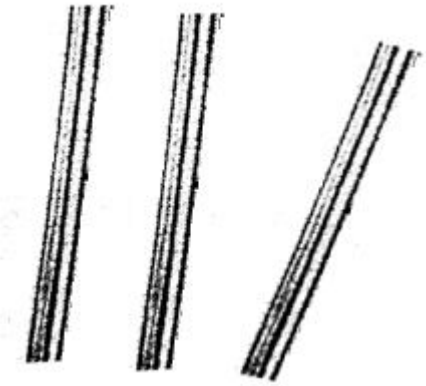


Fig. 3.5 Microscopic structure of silk

Microscopic properties

Strength: Silk is the strongest natural fibre. It has a tenacity of 2.4 to 5.1 grams per denier. More over smoothness of the silk filament yarn reduces the problem of wear from abrasion. The strength of the spun silk yarns depends on the length of silk staple.

Shape and appearance: Silk filaments are very fine and long. They frequently measure about 1000 to 1300 yards in length. The width of the silk is from 9 to 11 microns.

Elasticity: It is an elastic fibre and its elasticity varies as it is natural fibre. Silk fibre may be stretched from 1/7 to 1/5 its original length before breaking.

Cultivated degummed silk viewed longitudinally under a microscopic, resembles a smooth transparent rod under microscope. Silk in the gum has rough irregular surface. Wild silk tend to be quite uneven and is some what dark. It may have longitudinal striations.

Resilience: Silk retains the shape and resists wrinkling rather well. This is more in fabrics made from pure silk rather than spun silk or weighted silk.

Drapabilty: Silk has a pliability and suppleness' that aided by its elasticity and resilience gives it excellent drapability.

Heat conductivity: Since silk is a protein fibre. It is a non conductor of heat like wool. Hence it is used for winter apparel.

Absorbency: The good absorbtive property of silk also contributes to its effect in warmer atmosphere. Silk generally absorbs about 11% of its weight in moisture which makes silk for easy dying and printing.

Cleanliness and wash ability: Silk is hygienic material because its smooth surface does not attract dirt. It can also be easily cleaned by mild soaps and dry cleaning.

Shrinkage: Due to the filament in length, smooth surface silk have normal shrinkage which can be easily restored by ironing at moderate heat and damp conditions.

Effect of light: Continous exposure to light weakens silk faster than either cotton or wool.

Chemical properties

Resistance to mildew: Silk will not be affected by mildew unless left for time in damp state or under extreme conditions of tropical dampness.

Reaction to alkalis: Silk is not as sensitive as wool to alkalis. It may be affected in concentrations and high temperatures. Cold concentrated solutions of alkali such as soda or caustic potash has slight action on silk. Heated solution dissolved silk.

Reaction to acids: Concentrated mineral acids dissolve faster than wool. Organic acids do not harm them while medium concentrated HCL will dissolve silk.

Affinity for dyes : Silk has very good affinity for acid dyes but light fastness is unsatisfactory.

Resistance to perspiration: Silk fabrics are damaged by perspiration. The silk itself gets deteriorated in the presence of perspiration.

Reaction to bleach: Strong bleaches contain sodium hypochlorite will deteriorate silk. Mild bleaches like sodium perborate and hydrogen peroxide may be used with normal caution.

3.2.2 Uses of silk

Silk is an expensive luxury fabric used for making different garments. Silk is used primarily in apparel and home furnishing items because of its appearance and cost. Silk is extremely versatile and can be used to create a variety of fabrics from sheer chiffons to heavy beautiful brocades and velvets. Because of silk absorbency it is appropriate for warm weather wear. Because of its low conductivity it is used for cold weather wear,also in furnishing silk is often blended with other fibres to add soft luster for furnishing fabric. Occasionally expensive hands made rugs are made from silk.

3.3 History of Wool

Wool has the one of the first fibres to be converted into fabric. Wool fibre grows from skin of sheep. It is composed of protein known as keratin. It is crimp and has scales on its surface depending upon the breed of sheep. The natural protein fibre consist of amino acids. Wool has 19 amino acids, keratin, protein and other organic acids.

Man uses wool as clothing in the very early stages of human history. The primitive man is used it in the form of skin of certain animals to protect as well as to decorate his body. Man then discovered the use of hair of sheep after interlocking and twisting them together under pressure and thus hair of sheep were used in making fabrics The interlocking of woolen fabrics is known as felting.

Wool was probably known to the primitive man as he used sheep skin to cover his body even before the discovery of other fibres.

Wool is yellowish white fibre and has medium luster. It is considered to be weak fibre than many other fibres however other properties such as resiliency and elasticity compensate for low strength.

3.3.1 Structure of wool

When the wool is fibre is untwisted it shows a kinky appearance. The length varies from 1,1/2 to 18 inches, the long fibres are coarser than short fibres.

Fig. 3.6 Microscopic structure of Wool

When observed under microscope the surface of the fibre seems to be consisted to scales irregular of shape and slightly overlapping like scales of fish.

3.3.2 Classification of wool

1. Merino wool: Merino sheep produce the best quality wool which is originated from Spain.

Classification by fleece

1. Lamb's wool: The first fleece sheared from lamb about six to eight months old is known as lambs wool. This is in fine quality and soft texture.

2. Hogget wool: Wool obtained from sheep of 12 to 14 months old that has not been previously shorn.

3. Pulled wool: When sheep is slaughtered for meat the wool is pulled called as pulled wool.

4. Cotty wool: Very poor grade wool.

5. Wether wool: Any fleece clipped after the first shearing is called weter wool.

3.4 Manufacturing of Wool

Shearing

Sheep are generally shorn of their fleeces in spring but the time of shearing differs in different parts of the world. Machine clippers remove the fleece faster and closer than hand clippers. Superior wool variety comes from the sides and shoulders where it grows longer, finer and softer is treated as good quality fleece. Wool from the chest ,belly and shanks is treated as a second fleece.

Preparation

An average about 8 pounds of fleece is made from one sheep. Then the fibers are packed in bags or bales. The raw wool or newly sheared fleece is called Grease wool because it contains the natural oil of the sheep. When Greese wool is washed, it loses from 20 to 80% of its original weight. The grease known as yolk is widely used in the pharmaceutical industries for lanolin compounds.

Sorting and grading

Skilled workers do wool sorting. Each grade is determined by type, length, fineness, elasticity and strength. Separating of fibre by touch and sight.

Scouring

Washing of raw wool is an alkaline solution is known as scourcing. The wool is treated with warm water, soap, mild solution of soda ash or other alkali to remove dirt in the fibres.

If the raw wool is not sufficiently clear of vegetable, substance after scouring is put through the carbonizing bath. The fibres are then put through a dilute solution of sulphuric or hydrochloric acid which destroys any vegetable. This process is called as carbonizing and resultant wool is called 'extract'.

To remove the Grease and dirt in raw wool it is put through a series of naphtha balls followed by clear water to remove the naphtha. This is called naphtalation. This process improves the dye uptake property of wool.

Garnetting

Recycled wool fibres are obtained by separately reducing the unused and used fibrous mass by a picking and shredding process called garnetting.

Drying: Wool is not allowed to become absolutely dry usually about 12 to 16% of moisture is left in wool to condition it for subsequent handling.

Oiling: As wool is un manageable after scouring the fibre is usually treated with various oils including animals, vegetable, mineral or a blend of these to keep it from being becoming brittle o lubricate it for the spinning operation.

Dyeing: If the wool is to be dyed in raw stock it is dyed at this stage. Some wool fabrics piece dyed, some are yarn or skin dyed and some are top dyed.

Blending: Wool of different grades or pure wool fibres and other textile fibers may be blended mixed together at this point. All the information should be present on the labels.

Carding: The carding process introduces the classification of woolen yarns and worsted yarns. It makes the fibre parallel and some amount of dirt is removed due to straightening of fibres. Fibres are used for the worsted yarn are more straightened than the wool yarns.

Gelling and combing: The carded wool which is to be made into worsted yarn is put through gilling and combing operations. The geilling process removes the shorter staple and straightens the fibre. This process removes short fibres from 1 to 4 inch length places the long fibre as parallel as possible and further cleans the fibre by removing any remaining loose impurities.

Drawing: Drawing is an advanced operation for worsted yarns which doubles and redoubles slivers of wool fibres. The process draws, drafts, twists and winds the stock making slivers more compact and thinning them into slubbers.

Roving: This is the final stage before spinning roving is actually a light twisting operation to hold thin slubbers intact.

Spinning: In the spinning operation the wool roving is drawn out and twisted into yarn. Woolen yarns are chiefly spun on the mule-Spinning machine are worsted yarns are spun on any kind of spinning machine mule, ring, cap or flyer.

3.4.1 Properties of wool

Physical properties of wool

Strength: It is stronger than silk. When wet wool looses about 25% of its strength. Longer the fibre the greeter will be the strength of yarn.

Resiliency: Wool is highly resilient and comes to its original shape when hanged after wrinkled or created.

Stretchability: Wool is highly elastic. It is about 10 to 30% stretched when dry and 40 to 50% when wet upon receiving pressure upon drying it readily regains its original dimensions.

Shrink ability: Wool is resistant shrinkage. However long exposure to moisture may cause shrinkage.

Effect of friction: Friction will soften the wool fibre especially when wet and thus is advantageous in maintaining smooth, soft texture of fabrics.

Crimps: Wool fibre is more or less wavy and has twists. This waviness is termed as 'crimp'. Finer the wool the more will be the crimps in it. Merino wool has 30 crimps per inch while coarse wool has one or two.

Effect of moisture: Wool is the most hygroscopic in nature. It can absorb up to 50% of its weight and carry upto 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 sudden change in temperature.

Heat conductivity: Wool fibre is a part is a poor conductor of heat and therefore the fabrics made from the fibre are considered most suitable as winter wear.

Felting: Wool fibres interlock and contract when exposed to heat, moisture, and pressure. The scale like exterior of the fibres contributes to felting. The fibres get softened in weak alkaline solutions due to expansion of scales at their free edges, with friction and pressure they again interlock to form a felt. This property is used in making felts for hats, shoes, floor-coverings and sound proofing purposes.

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

Chemical properties

Action of acids: Dilute acids have little effect but either hot or concentrated acids weaken or dissolve the wool fibres.

Action of alkalis: Alkalis tend to make while wool yellowish, strong solutions of sodium carbonate when heated destroys the fibre sodium hydroxide is highly injurious to the wool fibre. However borax and ammonia have no harmful influence on wool.

Action of bleaching agents: Strong bleaching agents like hypochlorite have harmful effects on wool., potassium permanganate, sodium peroxide and hydrogen peroxide however can safely be used for bleaching and stain removal.

Effects of moth and mildew : Wool is easily damaged by moths that is why during storage of woolen garments special case is needed. However mildews donot effects garments.

Finishes given to wool: Felting, fulling, moth proofing, crabbing, decanting, london shrinking, napping, singeing and steaming.

Wool blends: Wool polyster, wool acrylic, wool nylon, silk and wool.

3.4.2 Uses of wool

The majority of wool (72.8%) is used in apparel, home furnishing account for 15-45%, industrial uses 6 to 7% and exports 5%, wool accounts for 3.3% of all fibres for apparel.

The most important use of wool is for apparel coats, jackets, suits, dresses, skirts, slacks made from woven fabrics of varying weights and knitted fabrics'. All these gives the warmth garments and with good tailored look.

In the home furnishing area the major use of wool is in carpets and rugs where wool is used more, cover to the carpets and warm in the rugs. Blends of different synthetic fibres with wool for suiting materials are increasingly important. This result in fabrics that are more appropriate in warmer conditions. Polyester is the most important fibre used in blending with wool.

Conclusion

Selection of a fibre, should be willing to pay for weaving quality. A good quality fibre (either silk or wool) is not cheap and priecs are tending to rise. Blends of fibres with man made and natural fibres have grown in importance. The consumer should read the percentage of each fibre and selling point on label.

I. Test your understanding

State whether the following statements are true or false

1. Silk fibre is the longest of all natural fibres. (T / F)

2. The process of unwinding the filament from the cocoon is called as spinning. (T / F)

3. Silk has great affinity for dyes. Acid dyes produce brilliant shades on silk. (T / F)

4. Wild silk has uneven structure and is some what dark compared to cultivated silk. (T / F)

5. Silk fabrics deteriorate and color is also affected due to perspiration. (T / F)

II. Test your understanding-2

State whether the following statements are true or false

1. Grade of wool is determined by type, length, fineness, elasticity of length (T / F)

2. Washing of raw wool in alkaline solution is known as reeling. (T / F)

3. Wool is non hygroscopic in nature. (T / F)

4. Wool fibres interlock and contract when exposed to heat moisture and pressure. (T / F)

5. Bleaching agents have no effect on wool. (T / F)

6. Wool can be blended by polster, acrylic, nylon etc.

Short Answer Type Questions

1. What is filament fibre?

2. What are the physical properties of silk?

3. What is the microscopic appearance of silk?

4. What are the uses of silk?

5. What is the microscopic appearance of wool?

6. Write the classification of wool?

7. What are the uses of wool?

8. What are the physical properties of wool?

Long Answer Type Questions

1. What are the chemical properties of silk?

2. Write the process of manufacturing silk fibre?

3. What are the various types of silk?

4. How do you manufacture wool fibre?

5. What are the chemical properties of wool? Write any 4 chemical properties in detail?

Answer for test your understanding - I

1. True
2. False (reeling)
3. True
4. True
5. True .

Answer for test your understanding - II

1. True
2. False (scoring).
3. False
4. True
5. False (strong bleaching agents like hypochlorite have effect on wool.
6. True.

UNIT 4

Manufactured Fibres

Structure

Learning Objectives

After studying this unit, you will be able to;

- Understand the manufacturing process of Rayon
- Identify the structure of rayon fiber.
- Describe the physical and chemical properties of rayon
- State the uses of the rayon
- State the types of polyester yarn
- Understand the manufacturing process of polyester
- Explain the physical and chemical properties of polyester yarn
- Classify the types of rayon.

Unit Preview

This unit gives us the information regarding the manufacture and properties of man-made fibers.

(1) Rayon

(2) Polyester.

4.0 Introduction

A rayon fiber was the first man-made composed of pure cellulose the substance of which is the man constituent of cell walls of trees and cotton. Rayon fibers are made from cellulose that has been reformed or regenerated. Consequently, these fibers are identified as "regenerated cellulose fibers". Because of its lustre and soft hand feel, it resembled silk and came to be known as "artificial silk". However it is more like cotton in its chemical composition

4.1 Rayon

History of Rayon

Robert Hooke, the English naturalist, had prophesied the production of a fiber such as rayon, the first of the man made fibers long ago in 1664. He believed that it was possible to make an "artificial glutinous composition" much resembling, if not fully like silk worm secretion George Audemars, a Swiss chemist, discovered how to make cellulose nitrate. In 1884, count Hilaire de chardonnet produced the first man made textile fibers from nitro cellulose. He is known as "father of Rayon".

Wood Rayon is produced in many ways. Viscose Rayon is popular among customers. It is made from pulp and cotton linters. The other is cellulose rayon (acetate rayon) in the chemist terminology, rayon and acetate are not synthetic because natural materials- cotton, linters and wood pulp are used in their manufacture, rather than chemical elements.

4.1.1 Source of Rayon

Rayon is an artificial, man-made or synthetic fibre made from cellulose. Commercially rayon was produced about 48 years back. Rayon produced at that time was very lustrous they were given this name which means "reflecting the rays of sun".

The main objective in manufacturing rayon was to provide a cheap substitute for silk. India has been importing rayon fabrics and rayon yarn.

4.1.2 Structure or Rayon

When seen under microscope, the fiber appears smooth and rounded. Viscose rayon fibers are rod like with numerous, longitudinal, thread like striations or lines. These are due to the indentations of fiber surface.

Fig. 4.1 Microscopic structure of Viscose Rayon

4.1.3 Manufacture of Rayons

All types of rayon are made from cellulose. There are main four main procedures by which cellulose is transformed into rayon. They are

(1) The nitrocellulose process

(2) The cuprammonium process

(3) The viscose process

(4) The cellulose acetate process.

The general principles of rayon yarn production involve the following steps.

(a) To treat cellulose chemically for rendering from it a liquid

(b) To force the liquid through fine holes

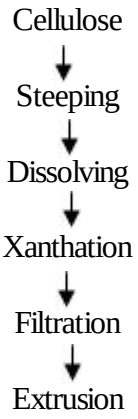
(c) To change from liquid stream into solid cellulose filaments.

The Viscose Process

This is discovered in 1892 in England. In this process Spruce, a type of treechipsareused. Spruce logs are reduced to wood pulp and purified for cellulose base. Wood pulp is treated with caustic soda to form alkali cellulose. It is treated with carbon disulphide to form cellulose xanthate. This is dissolved in dilute

caustic soda solution. A reddish or orange liquid is formed. This liquid is filtered and then kept for ageing until a thick fluid is formed which is called 'Viscose'. This fluid is forced through fine jets into a dilute solution of sulphuric acid. In this way cellulose is regenerated into continuous fibers.

The largest production of rayon today is manufactured by this process. The cost is low.



4.1.4 Properties of Rayon Fabrics

The development of man-made fibers possessing along with the prized qualities of the natural fiber is a tribute to human ingenuity.

Characteristics of Rayon Fabric

- Highly Absorbent
- Soft and comfortable
- Easy to dye
- Drapes well

Physical Properties

Strength : The tensile strength of viscose rayon is greater than that of wool but is only half as great as silk. Viscose rayon is also weaker than cotton and its strength is reduced to 40 to 70 percent when wet. Yet it produces fairly durable, economical and serviceable fabric whose smoothness of surface favorably withstands with friction of wear

Elasticity : Viscose rayon has greater elasticity than cotton but less than wool and silk. While viscose rayon fabrics have some inherent extensibility, undue strain might cause them to sag or even burst.

Resilience : Viscose rayon lacks the resilience. It should be remembered that the resistance of a fabric to creasing depends on the kind of yarn, weave and finishing process.

Drapability : Viscose rayon possesses a marked quality of drapability because it is relatively heavy weight fabric.

Heat Conductivity : Viscose rayon is a good conductor of heat and is therefore appropriate for summer clothing like cotton.

Absorbency : Viscose rayon is one of the most absorbent of all textiles. It is more absorbent than cotton or linen, but less than wool and silk.

Cleanliness and Washability

Because of smoothness, Viscose rayon fiber helps to produce hygeinic fabrics that shed dirt. Since Viscose rayons temporarily looses strength when wet, it must be handled with care when washed.

Reaction to Bleaches : Household bleaches containing sodium hypo chlorite, sodium perborate or hydrogen peroxide may be safely used.

Shrinkage : Viscose rayon fabrics tend to shrink more than cotton fabrics. Spun Viscose rayon fabrics shrink more, which can be given a shrink resistant finish, such as Sanforset.

Effect of Heat : Viscose rayon is pure cellulose fiber which burns as cotton. When ironing, only moderately hot temperature must be used.

Chemical Properties

Resistance to Mildew : Like cotton, Viscose rayon have tendency to mildew. Such fabrics should not be allowed to remain in damp conditions.

Reaction to Alkaline : Concentrated solutions of alkalies disintegrate Viscose rayon. A mild soap with lukewarm water is recommended in washing rayons.

Reaction to Acids : Being pure cellulose, the fabric is disintegrated by hot dilute and cold concentrated acids similar to that of cotton.

Affinity of Dyes : Viscose rayon fabrics absorb dye evenly and can be dyed with a variety of dyes, like acid, chrome, and disperse.

Resistance to Perspiration : It is fairly resistant to deterioration from perspiration.

4.1.5 Uses of Rayon Fiber

Apparel : Accessories, blouses, dresses, jackets, lingerie, linings, millinery, slacks, sports shirt, sportswear, suit, ties, work clothes.

Home Furnishings : Bed spreads, blankets, curtains, draperies, sheets, slipcovers, table clothes, upholstery.

Industrial Uses : Industrial products, medical products, non-woven products.

Other Uses : Feminine hygiene products.

It's used in industrial wipes, medical supplies, including bandages, diapers, sanitary napkin, and tampons in non-woven fabrics.

4.2 Polyester Fiber

Polyester is a synthetic fiber invented in 1941. The first polyester fiber is known as 'Dacron' in America and 'Terylene' in Britain. Later various types of polyesters are produced. Terylene fiber is made by synthesizing terephthalic acid and ethylene glycol.

The ground work for development of polyester fiber is done by W.H. Carothers. Polyester fiber is the long chain polymer produced from elements derived from coal, air, water and petroleum. Polyester is a thermoplastic fiber and has good strength. It melts in flame and forms a grey hard non-crushable bead. It is an easy care fabric and can be easily washed.

Polyester fiber looks like a smooth, glass rod similar to Nylon. If delustered it shows black spotted appearance. The length, width, shape and luster of the polyester fibers are controlled during manufacture to suit a specific end use. It is mostly blended with other fibers to improve its absorbency and to lower static electricity.

4.2.1 Method of Manufacture

Generally each company produces its own variety of polyester through there are likely modifications under specific trademarks.

Eg : PET (Principle raw material is ethylene diamine and terepthalic acid) obtained frpm petroleum and PCDT polyester.

Spinning of Fiber

The molten polymer is rigourously maintained at airtight condition, as oxygen will affect its stability. The viscous melt is extruded through spinneret, and the

filaments are subsequently drawn into desired polyester fiber. Variations in production process depends on desired end results.

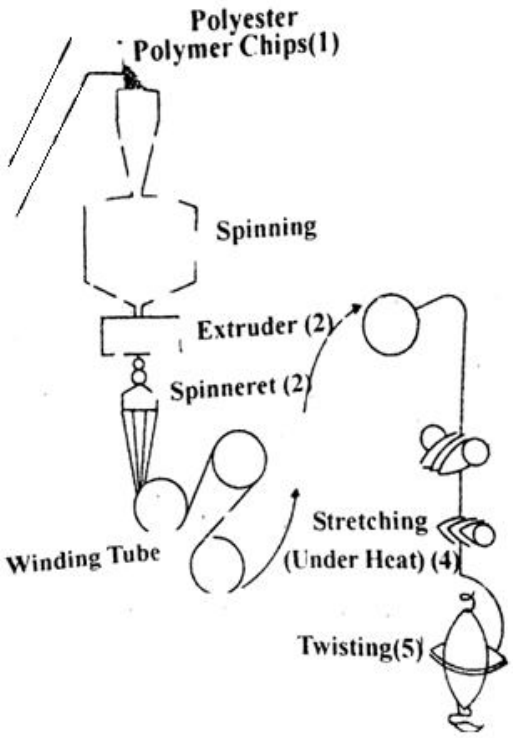


Fig. 4.2 Flow chart of manufacturing process of polyester

The holes of spinneret may be round or modified to be trilobal, pentagonal, hexagonal or octagonal shapes so as achieve specific effects such a greater cushioning and insulative properties. Other properties may be obtained with the aid of specific additives given to the spinning solution.

Upon extrusion of spinneret, the polyester filament does not have all the desired characteristics because of random arrangement of polymer molecules. The fibers are therefore drawn or elongated with the aid of godet wheels. The temperature conditions and the extent to which the fibers are drawn to 5 times their original length.

Types of Polyester Yarn

The diameter of the polyester yarn is determined by;

(a) The rate extrusion of filaments from the spinneret.

(b) The number of spinneret holes and therefore the number of filaments

(c) The rate of drawing of filaments. The yarn comes in a wide range of diameter and staple lengths. The yarns are produced basically, as monofilament, multifilament and spun and sometimes the textured yarns are also produced.

4.2.2 Properties of Polyester Fabrics

Properties of Polyester

- It resists wrinkling.
- It is easy to launder
- It dries quickly
- It's resistant to stretching.

Physical Properties

Shape and Appearance : These fibers are generally round and uniform. The fiber is partially transparent and white to slightly off -white in colour.

Strength : The PET polyesters are in general, stronger. Polyester is found in industrial uses and the highly durable fabrics.

Elasticity : Polyester fibers do not have high degree of elasticity. In general polyester fiber is characterized as having a high degree of stretch resistance, which means that polyester fabrics are not likely to stretch out of shape too easily.

Resilience : Polyester fibers have high degree of resilience. Not only does a polyester fabric resist wrinkling when dry, it also resists wrinkling when wet.

Drapability : Fabrics of polyester filament have satisfactory draping quality. Polyester spun yarn is flexible and softer, thereby draping quality is improved.

Heat Conductivity : Fabrics of polyester filament are good conductors of heat. Polyester staple does not provide greater insulation in the yarns and fabrics. One of the reason for apparel greater warmth of polyester is its low absorbency.

Absorbency : Polyester is one of the least absorbent fibers. This low absorbency has important advantages- they will dry very fast, suited for water repellent purposes, such as rain wear and they do not stain easily.

Dimensional Stability : If the polyester is properly heat set, it will not shrink, nor stretch when subjected to boiling water, boiling cleaning solvents or ironing temperatures that are lower than heat setting temperatures.

Shrinkage : Polyester fabrics shrinks as much as 20 %during wet-finishing operations and they are generally heat set in later treatments. They have excellent dimensional stability.

Cleanliness and Washability : Since polyester fibers are generally smooth, has low absorbency, many stains lie on surface, and are easily washed, by hand or machine but oil stains are very hard to remove.

Chemical Properties

Reaction to Alkalies : At room temperature, polyesters has good resistance to weak alkalies and fair resistance to strong alkali. It reduces with increase in temperature and alkalies concentration.

Reaction to Acids : Depending upon type, polyester has good resistance to mineral and organic acids. Highly concentrated solutions at high temperatures cause degradation.

Eg: Sulphuric Acid.

Effects of Bleaches : Fabrics of polyester may be safely bleached, because polyesters have good resistance to deterioration to household bleaches. If the polyester have optical brightener, bleaching is not necessary.

Effect of Heat: Ironing should be done at low temperature. It gets sticky at 440^0 F.

Effect of Light : Polyester has good resistance to degradation by sunlight. Over prolonged use, gradual deterioration of fiber occurs.

Affinity for Dyes : Polyesters are dyed with appropriate disperse, developed dyes at high temperatures producing a good range of shades and color fastness.

Resistance to Perspiration : Polyesters has no loss of strength from continued contact with either acid or alkaline perspiration.

Polyester Blends : Polyester cotton blend, polyester wool blend, polyester rayon, polyester silk blend, polyacetate blend, , polyester and nylon are some common blends.

4.2.3 Uses of Polyester

The most important uses of the polyester is in “woven fabrics”. The blended fabrics are attractive, durable and comfortable, retain their appearance well and easy care. The first use of staple polyester was in tropical suiting for men’s summer suits. The suits were light in weight and machine washable.

Polyester and polyester blends are also used in home-furnishings, sheets, blankets, bed spreads, curtains that match bed spreads, mattress ticking, table clothes. They are used in upholstery fabrics; polyester carpets have a softer hand than nylon carpets. Spun yarn are used in knitted fabrics. Here polyester with cotton blends are used.

The other important use where it is used is as fiber fill. Used in pillows, comforters, bedspreads, other quilted households and apparels, winter jackets etc.

Non-woven fabric are the fourth important use of the polyester fabrics eg: fusible interfacings, pillow covers, matress interlining etc.

It has many industrial uses too in pile fabrics, tents, ropes, cording, fishing line , cover stock for disposable diapers, garden hoses, sails, seat belts, filter fabrics used in road buildings, fertilizer bags, in medicinal field for artificial arteries, veins and hearts.

Conclusion

Consumers are mostly aware of the fiber content with fibres and their blends. The man-made fibres like rayon, polyester to have qualities of stability, durability, comfort, wrinkle resistance ease of care etc.

I. Test your understanding

State whether following statements are True or False.

(1) Rayon is the first man-made fibres made from cellulose. (T / F)

(2) Acetate rayons are rod-like with no striations. (T / F)

(3) Nitrocellulose process is first used for production of rayon fabrics. (T / F)

(4) The largest production of rayon is done by cuprammonium process. (T / F)

(5) Viscose rayon tend to shrink more than cotton fibers.(T / F)

II. Test your understanding

State whether the following statements are True or False

(1) Diameter of polyester yarn is determined by extrusion of filaments of spinneret, no. of filaments and rate of drawing filaments. (T / F)

(2) Polyester fabrics are bad conductors of heat. (T / F)

(3) Polyesters is used for the water repellent purposes and will not stain easily due to its hygroscopic nature. (T / F)

(4) Polyester is unaffected by moths, carpet beetles, silver fish or other insects. (T / F)

(5) Polyester has good resistance for degradation by sunlight. (T / F)

Short Answer Type Questions

(1) What is a man-made fiber? Who was the father of rayon industry?

(2) What is the microscopic appearance of rayon?

(3) What are the uses of rayon?

(4) What are the physical properties of rayon?

(5) What is the microscopic appearance of polyester?

(6) What are uses of polyester?

(7) What are the physical properties of polyester?

(8) Write the drapability in polyester fiber?

Long Answer Type Questions

(1) What are the chemical properties of rayon?

(2) Write the manufacturing process of rayon by Viscose process?

(3) What are the chemical properties of polyester?

(4) Write in detail, about manufacturing process of polyester fiber?

(5) Explain the use of polyester?

Answer for test your understanding - I

(1) True

(2) False (cuprammonium process)

(3) True

(4) False (Viscose process)

(5) True

Answer for test your understanding - I

(1) True

(2) False

(3) False (due to low absorbency property)

(4) True

(5) True

UNIT 5

Spinning and Yarns

Structure

Learning Objectives

After studying this unit, the student will be able to

- Understand about the classification of yarns.
- Know about end uses of ply yarns
- Know about end uses of corded yarns
- Know about novelty yarns and types
- Understand yarn-twist.
- Explain the yarn count and balance of cloth.

Unit Preview

This unit gives us the information regarding the classifications of yarns, turst in the yarns, balance of cloth yarn count and novelty yarns.

5.0 Introduction

Spinning is the process of drawing out and twisting of a group or bundles of fibres into a continuous thread or yarn of sufficient strength to be woven or knitted into fabrics.

In the beginning the yarns were spun by mane with bare hands without the aid of any tool and it must have been many centuries before the spindle was evolved for spinning. The spindle or "takli" still survives as a tool hand spinning wool, silk and cotton yarn.

It is the simplest tool which consists of a round disc which is attached in the center to a thin, smooth rod about inches long. The upper end of the rod has a groove or a hook which bulk of the fibres, these are drawn out in a long stand. The spinner while simultaneously pulling the fibres, gives a twist to the spindle and let it go. The spindle whirl around and thus twisting up the pulled fibres makes a continuous thread. The thread is then woven round the rod above the disc. The disc provides the necessary weight which quickens increases and prolonged the revolving of the rod, thereby the twisting of the fibre ensures a strong thread.

Who does not know the "charka" in India. A charka is used for spinning yarn in the handloom industry in India. The yarn spun on the charkha is of various qualities. The famous "Dacca Muslins" which were uncomparable for their fineness but alas are extinct now were woven of a charka yarn. The inimitable soft and light pashmina of Kashmir are still woven of the charkha spin yarn.

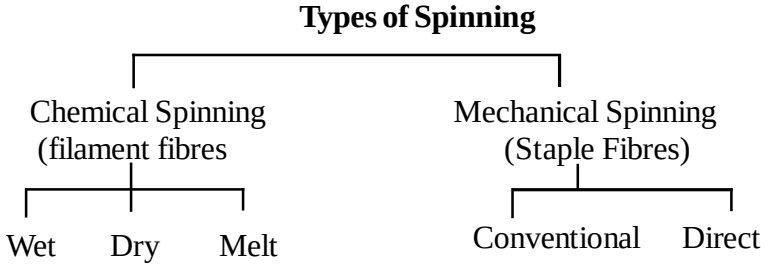
Charkhas are of various types. In the textile industries today electrically driven machines are employed for spinning. Several machines are used to complete the process of spinning, which consists of stages such as drawing out of fibre to reduce size and to give slight twist-roving and then spinning. There are two general methods of procedure. In one process, the action of drawing, twisting and winding is continuous and this is called 'ring' spinning and in the other, the drawing and twisting is stopped while the twisted thread is wound up (as in the case of hand spinning) and this is known as 'mule spinning'. The ring spinning is a quicker process and has the advantage of reducing operating cost and increase production, but the mule spun is finer, softer and of greater evenness.

In spinning yarns, whether by hand or machine a difference has to be made in the yarn intended for warp and weft or filling. The warp yarn needs a greater amount of twists to produce a strong firm thread which is used for the foundation of the fabric. The yarn is given twists of specified number of turns per inch. At first, a continuous thread or a strand is made from fibres and several of these strands are twisted together to get a final yarn.

Depending upon the fibres, the preparatory methods of spinning are classified into two types:

(1) Chemical spinning – filament fibres

(2) Mechanical spinning – for the short staple fibres



(1) Chemical spinning

Chemical spinning operations are generally used to make man-made filament fibers to yarns. A viscous solution is extruded through a nozzle like die called a spinneret. Man-made fibers are made into yarns by chemical spinning.

There are three types of chemical spinning.

They are (1) Wet spinning

(2) Dry spinning

(3) Melt spinning

Wet Spinning

The first commercial method for manufacture of manmade fibre is wet spinning of cellulosic fibre-rayon. This process involves the use of appropriate liquid solution which is pumped through small nozzle called spinneret, into a chemical bath that coagulates the extruded solution of endless strands of filaments. These coagulated continuous fibers are drawn out of bath, purified by washing, dried and then wound onto spools. The construction of spinneret decides if it is a mono-filament, if one hole, Multifilament if many holes are present in the spinneret. The amount of twist given to the processed yarn will affect texture and strength.

Dry Spinning

This process involves use of fiber liquid solution which is pumped through spinneret into an air chamber. The air reacts with extruded streams, of liquid

fiber causing them to solidify. These coagulated fibers are then drawn out of chamber, twisted, or processed then wound onto spools.

Eg. Acetate

Melt spinning

Polyester chips obtained from reacted chemical combinations are melted and then pumped through spinneret into an air chamber. The extruded stream cools and solidifies into continuous filaments which are then drawn out from chamber twisted or processed or subsequently wounded onto spoons.

Eg. Polyester

(2) Mechanical Spinning

Mechanical spinning refers to a multistep procedure in which machines physically manipulate and spin fibres into yarns. There are two types of mechanical spinning. They are (1) Conventional spinning

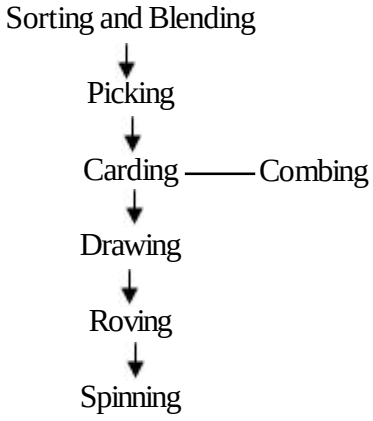
(2) Direct spinning

Conventional spinning is used to make yarns from natural staple fibres and some man-made fibers. It involves series of machine operations.

Direct spinning is used to produce staple yarns from filament fibers.

Conventional spinning

Basically conventional spinning involves sorting and blending, formation of web for ease of handling, alignment of fibers, stretching of fiber bundles and actual spinning of fibres into yarns.



(1) Sorting and Blending: The first step in conventional spinning of staple fibers is sorting and blending. Bales of fibres are loosened and fluffed. Impurities such as dirt and leaves are removed and fibers are blended to product specifications.

(2) Picking: It is the second step in conventional spinning. The fibers are formed into web like sheets for ease of handling. These fiber webs are called laps. The forming of staple fibers into laps is called picking.

(3) Carding: The fiber web is fed into a carding machine, which straightens the fibers and partially arranges them into parallel rows. The aligned fiber web is then formed into a long, untwisted rope called a sliver . The process of separating and aligning the fibers is called carding.

(4) Combing: When only long, smooth staple fibers are desired the short fibers are removed from the slivers in a combing machine. Removal of short fibers and alignment of the remaining long fibers into parallel rows is called combing.

(5) As only long fibers are used, combing increases luster and strength. Thus a fabric composed of yarns than that have been combed will be more expensive than a fabric composed of yarns that have only been carded.

(6) The **drawing** process uses four sets of rollers, each set rotating at faster rate of the previous set several sliverss are combined and pulled into one long, then slivers. If further blending is desired, sliverss of different fibers may be combined in the drawing process.

(7) In **roving** the drawn sliverss are pulled to approximately one fourth of their original diameter and slight twist is added. Hence roving is process that reduces the sliverss to a size suitable for spinning.

(8) There are three systems of conventional spinning a) cotton b) woolen (c) worsted

They utilize the steps previously discussed. Here the machinery is designed to handle specific type and length of fiber involved.

Conventional Spinning

Cotton	Woolen	Worsted
eg. cotton, linen man made fibers	eg. wool and fur fibres and staple length man made fibres	eg. long fibres with high degree turst

Direct spinning

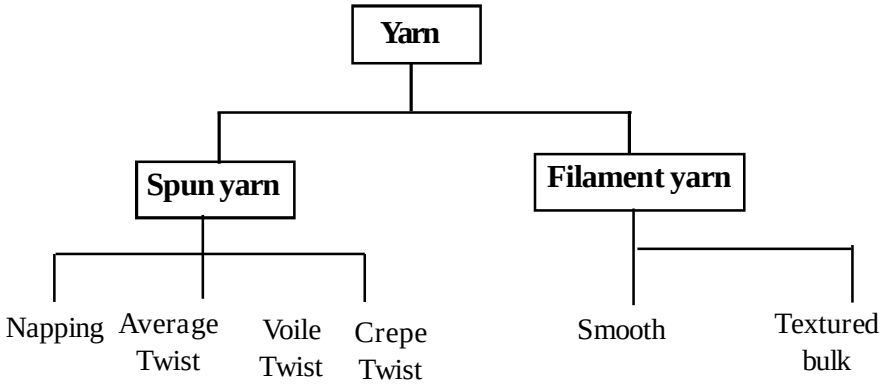
It is used to produce staple yarns from man-made filament fibers. It is less expensive. In the direct spinning, web like structures of filament fibers are stretched and broken at intervals producing long staple fibers. The staple fibers are then drawn into sliverss. The remaining spinning process is done by the following steps.

Filament fibres stretched
↓
Breaking
↓
Drawing
↓
Roving
↓
Spinning

5.2 Yarns and Classification of yarns

Yarns can be classified based on length of fibres present and number of parts present. According to the length of fibres present in yarn.

Yarn are broadly classified as staple/spun, yarns or continuous filament yarn. Spun yarn consist of staple fibre assembled and bound together by twist to produce the required characteristics such as strength, handle and appearance.



5.2.1 Spun Yarns

Spun yarns are made from the staple fibres that are twisted together. Spun yarns are characterized by protruding fibre ends. Spun yarns strength is dependent on the cohesive or the clinging power of the fibre and on the points of contact

resulting on pressure of the twist. The greater the number of points of contact, the greater is the resistance to the fibre slippage within the yarn.

They are suited to clothing fabric in which absorbency, bulk, warmth or cotton like or wool like textures is desired. When worn fibre ends hold the yarns away from close contact from the skin, and so fabrics made of spun yarn is more comfortable on a hot humid day than a fabric of smooth filament yarns. Protruding ends contribute to a dull fuzzy appearance, to the shedding of lit and to the formation of pills on the surface of the fabric. They also get dirted readily, spun yarn can be given different types of twist based on the end use as napping twist.

Napping twist: This type of yarn is called as low twist, yarn. It has 2.3 turns per inch such low twist results in lofty yarns which allow for napping of fabric. Thus napped fabrics are bulky and provides warmth when used in garments.

Average Twist: It is frequently used for yarns made of staple fibres and is very seldom used for filament yarns. The amount of twist that gives warp yarns maximum strength is referred to as standard warp twist.

Hard twist (Voile twist): When yarns are given 30-40 turns per inch, they are called hard/voile twisted yarns. The hardness of the yarn results when twist brings fibres closer together and more compact.

Crepe Years: Crepe yarns are made of with either staple or filament fibre. Crepe is a French word meaning crinkle. They are made with a high number of turns per inch (40-80) inserted in yarns. This makes the yarn so lively and kinky that the twist must be set before it can be woven or knitted filament crepe yarns are used in fabrics like Georgette and chiffon.

5.2.2 Filament Yarns

The range of filament yarns is as diverse as that of staple yarns. Filaments yarns are divided into two types viz flat continuous filament and textured continuous filament yarn.

(a) Continuous filament yarns are provided from long continuous filaments. Filaments yarns are primarily man-made. Silk is the only natural filament and accounts for less than 1% of the fibre and yarn production. Regular or conventional filaments yarns are smooth and silk like as they come from the spinneret. Their smooth nature gives them more luster than spun yarns, but the luster varies with the amount of the delusturing agent used in the fibre spinning solution and the amount of twist in the yarn. Filament yarns have no protruding

ends, so they do not shed lint; they resist pilling and fabrics made from them tend to shed soil easily.

(b) Textured continuous yarn are man-made continuous filament yarns that are been modified by subsequent processing to introduce crimps, coils, loops or other distortions into the filament or with high twist or low twist. The addition of twist increases bulk texturing gives slippery filaments the aesthetic property of spun yarns by altering the surface characteristics and creating space between the fibres. It also improves the thermal and moisture absorption of filament yarns.

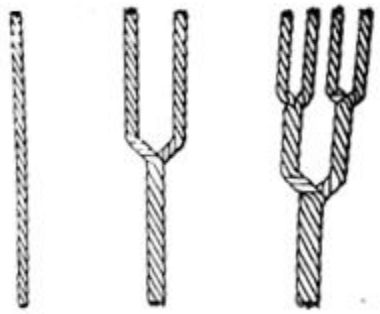
According to the number of parts in Yarns

1. Simple Yarn.

In the construction of simple yarn, only one kind of fibre is used. The manner in which the fibres are twisted will be the same throughout the length of the yarn. Yarns are known as simple, ply or cable depending upon the number of strands they contain.

2. Single Yarn

In this, a number of fibres are twisted together into a continuous length. The yarns consists of one kind of fibre. This type of yarn is the one usually found in most standard fabrics for clothing and household use and purposes.



(a) Single yarn (b) Two ply yarn (c) Cord yarn

Fig. 5.1 Types of Yarns

3. Ply yarn

Two or more than two single yarns are twisted together to form a ply yarn. These yarns are known as multiple strand yarn. If two single yarns are twisted together, the resulting yarn is known as two-ply yarn. If three are twisted together three-ply yarn and so-on.

4. Cord/Cable

It is made by a third twisted operation, in which ply yarns are twisted together. Some types of sewing threads and some ropes belong to this group. Cords are seldom used in apparel fabric, but used in industrial weight fabrics.

Fig. 5.2 Parts of Yarn

Double Yarn

This consists of two or more single strands treated as one in the weaving process, but the strands are not twisted together. These are used for ornamental effect as the low twist yarns produce luster and softness.

5.2.3 Novelty Yarns

The construction of these yarns is of complex nature and is varied in many ways. These yarns are usually ply yarns of different kinds of fibres or of different colours and are irregular rather than smooth single strand or yarn of various colours, sizes of fibres may be twisted together to form complex yarn. Another variety is brought about in this kind of yarn by varying the tension or speed after intervals of certain length. Thus allowing one part to loop or twist around the other. Novelty yarns are also constructed from simple yarn by varying the amount of twist. The complex type of novelty yarn is used with two objects in view one is to combine different fibres eg. Cotton and rayon may be blended with or covered by wool or silk. This lowers the cost of production. The other objective is to produce a novelty yarn. For the construction of novelty yarns, at least one

or two single yarns are use. One forms the foundation yarn known as a base or the core and the other, The effect of yarn which is wound or looped round the first one. A third yarn called binder yarn is often used to fasten or tie the effect yarn to the foundation yarn. These types of yarns are mostly used for drapery, up hoistery fabrics.

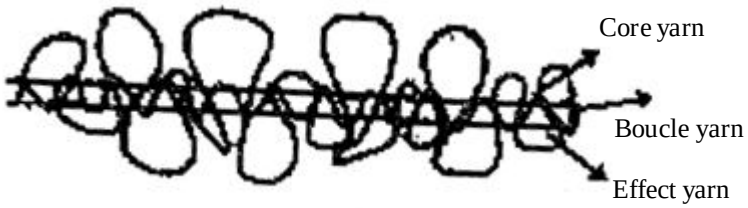


Fig. 5.3 Parts of Novelty Yarn

5.2.4 Types of Novelty Yarns

Slubyarn: This is a yarn made with thick and thin placing by varying the amount of twist in the yarn at regular intervals. They are found in drapery and upholstery fabrics.

Fig. 5.4 Slub yarn

Flock yarn: These are frequently called as flake yarns. These are usually single yarns in which small amount of fibres either different colours or luster or both are inserted into the yarn and held in place by twist of base yarn eg: tweed fabric. This gives a spotted and short streaky appearance.

Fig. 5.5 Flock yarn

Thick and thin yarns: These are similar to slub yarns but these are made from filament like slub prepared from staples. The pressure forcing the spinning solution is varied the filament is thick in some places and thin in some.

Fig. 5.6 Thick and thin yarn

Boucle Yarn: These are characterized by a projecting from the body of the yarn at fairly regular intervals. There are 3 ply yarns. The effect yarns forms irregular way surface and binder ties it to the base. It has twisted core yarn.

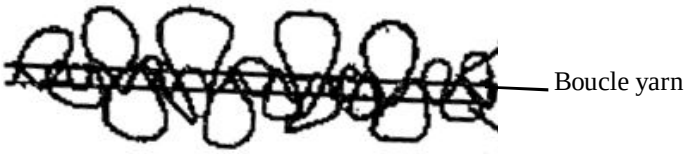


Fig. 5.7 Boucle Yarn

Loop and curl yarn, Gimp yarn: Gimp is same as boucle but the effect yarn is regular semi circular appearance, while in loop.

Snarl yarn or spike yarn: This is made in the same way as loop yarn using a highly twisted effect yarn, which forms snarls rather than loops.

Knop (button) yarn/knot/Nub/Spot yarn: This feature prominent bunches of one or more of the component yarn at regular or irregular intervals. This is made on a special machine that permits the base yarn to be held almost stationary while the effect yarn is wrapped around it several times to build upon enlarged segment with brightly coloured fibres added at the enlarged spot.

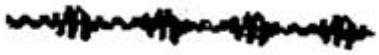


Fig. 5.8 Knop yarn

Seed or Splash: They resemble knops or knot yarns but the knot segments are tiny in seed yarn and elongated in splash yarn.

Cloud: A two coloured yarn, in which both yarns take in turn to obscure or cloud the other, giving the appearance of an intermittent color change.

Spiral or Corkscrew : It is made by twisting together two ply yarns that differ in size, type or twist. These two parts may be delivered to the twister at different rates of speed.

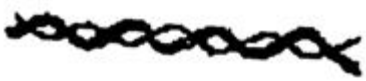


Fig. 5.9 Spiral yarn

Chenille Yarn: These create special effects chenille means caterpillar in French. The yarn has a cut pile effect which is bound to the core on the loom warps are arranged in groups (2-6) which are interlaced in a cross weaving manner. Weft is inserted in a normal manner. These are cut into wrap way threads.

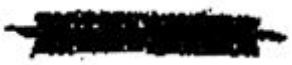


Fig. 5.10 Chenille Yarn

Metallic Yarn: These are primarily decorative. The plastic coasting on it resists tarnishing but care must be taken while pressing as pure metals are soft, their thin films are used over a core yarn that has replaced gold and slivers now. There are two methods of pressing.

Yarn twist: Twist is the spiral arrangement of the fibres around the axis of the yarn. Revolving one end of the fibre strand while the other end is held stationary produces twist. Twist binds the fibres together and gives the spun yarn strength. It is a way to vary the appearance of fabrics. The number of twists is referred to as turns per inch. They have a direct bearing on the cost.

Twist is the spiral arrangement of the fibres around the axis of the yarn. Revolving one end of the fibre strand while the other end is held stationary any produces twist. Twist binds the fibres together and to gives the yarn. Higher twist which yields lower productivity.

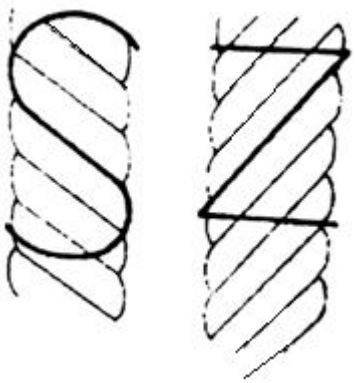


Fig. 5.11 Yarn twist

Direction of Twist

The direction of twist is described as s-twist and z-twist. A yarn has S-twist if when held in a vertical position, the spiral confirm the direction of slope

of the central portion of the letter "Z". Z-twist is the standard twist used for weaving yarns. The majority of single yarns are spun with twist in Z-direction.

The Amount of Twist varies with

1. The length of fibres
2. The size of the yarn
3. The intended use

5.2.5 Yarn count

Yarn number varies and it differs according to the kind of fibre. Many yarns are used for weaving and sewing threads are numbered by the cotton system. Spun yarn size is referred to as count and is expressed in terms of length per unit of weight. It is an indirect system. The finer the yarn, the larger the number. The count is based on the number of hanks (1 hank is 840 yards) in 1 pound of yarn. In this system the unit of weight remains constant.

Count = length / one pound.

Count = No of hanks x 840 yards / one pound.

Denier: Filament yarn size is dependently part on the size of the holes in the spinneret and partly on the rate at which the solution is pumped through the spinneret and rate at which it is withdrawn.

The size of the filament yarns is determined as denier, which is expressed in terms of weight per unit length. If 9000 meters of yarn weigh 1 gm it is then 1 denier. In this system, the unit of length remains constant. The finer the yarn, the smaller the number.

Denier = weight of yarns in gms/9000 mts.

1 denier = 9000 mts weigh 1gm

Tex system: The international organization for standardization has adopted the Tex system, which determines the yarn count or number in the same way for all fibre yarns and uses metric units.

Tex = weight in gms/100 mts of yarn.

Conclusion

There are different types of yarn. Each having the own characteristics. These characteristics vary according to the construction and the treatment given in the manufacture of the yarn. Yarns play a very important role in determining the hand and performance of the fabric. Yarn is the generic name for the assemblage

of fibres that is laid down or twisted together. Thus yarns play an important role in the textile industry.

I. Test your understanding

State whether the following statements are true or false

1. The three types of spinning are wet, dry and melt spinning in chemical spinning.
2. Dry spinning is used to make polyester.
3. The construction of spinneret decides the diameter of the fiber and the type of fibre i.e. mono filament and multifilament depending on number of holes.
4. Conventional spinning utilizes the steps discussed for (a) Cotton (b) Wool (c) Worsted fibers too.
5. Direct spinning is used to produce staple yarns from natural fibres.

II. Test your understanding

State whether the following statement are True/False

1. The warp yarn needs a greater amount of twist to produce strong firm thread (T/F).
2. Spun yarn consists of filament fibres (T/F).
3. Napping can done to low-twist yarns. (T/F).
4. Crepe is French word meaning crinckle (T/F).
5. In simple yarn one kind of fibre is used. (T/F).
6. When two or more than two single yarns are twisted together, it is called cable (T/F).

III. Test your understanding

State whether the following statements are True/False

1. Novelty yarns are mostly used for upholstery, drapery. (T/F)
2. Twist is the spiral arrangement of fibres around the axis of the yarn. (T/F)
3. The direction of the twist is described as X-twist and Y-twist. (T/F)
4. The count is based on number of hanks in 1 pound of yarn. (T/F)

5. Denier – Weight of yarns in gms/1000 mts (T/F).

Short Answer Type Questions

1. What is yarn?
2. What are spun yarn.
3. Write about continuous filament yarns.
4. Write about novelty yarns.
5. What is yarn twist.
6. What is yarn count?
7. Write about tex system.

Long Answer Type Questions

1. Write the classification of yarns.
2. What is filament yarn? Write about textured continuous yarns.
3. What are novelty yarn? Write any four types of novelty yarns.

Answers for test your understanding - I

(1) True

(2) False (acetate)

(3) True

(4) True

(5) False (man-made fibres)

Answers for test your understanding - II

1. True
2. False – Staple fibres
3. True
4. True
5. True
6. False – Ply yarn

Answers for test your understanding - III

1. True
2. True
3. False – S & Z twists
4. True
5. False – 9000 mts.

4. Write in detail about yarn twist.

UNIT 6

Fabric Construction Methods

Structure

Learning Objectives

- Understand what is weaving
- Understand the general categories of non wovens a) durable b) disposables
- Explain the semi durable wovens.
- Know about a) Weft knitting b)Warp knitting
- Classification of weft knit fabrics
- Design in weft knit fabrics
- Identification of warp knits.

Unit Preview

This unit gives us the information regarding the fabric construction methods such as

(a) Weaving

(b) Knitting

(c) Non woven fabrics.

6.0 Introduction

Fabrics are produced mostly from yarns. Few fabrics are directly produced from fibers. In Indian market 70% of the fabrics are produced by weaving. Among the other fabrics that is non woven fabrics lace making is worth mentioning along with needle punched and tufted fabrics. Felts are fabrics made directly from fibers without making yarns where fusible use is mostly emerging now a day.

The fabric construction process determines the appearance and texture the performance during use and care and cost of fabrics. The process often determines the name of the fabric for eg: felt lace, double knitt and jersey. The cost of fabrics in relation to the construction process depends upon the number of steps involved and the speed of process, the fewer the steps the faster the process, the cheaper is the fabric.

The fabric construction methods include weaving, knitting and non woven fabrics.

6.1 Weaving

Yarn is turned in to fabrics of garments by weaving, knitting, or felting.

Fabrics are woven in long lengths from 40 to 100 or more yards and from about 20 to 60 inches in width. For a fabric to have strength and compactness combined with a fair degree of elasticity, the warp and filling threads must be interlaced. This interlacing is called weaving and it is done on a loom.

An interlacing where the filling threads are passed alternatively over and under the warp threads is called as a plain weave. It is the simplest of all weaves.

If the fillings threads are passed one over and 2 under or more warp threads will result in twill fabrics. The surface of such fabric has pattern of parallel diagonal ridges.

If the warp threads or filling threads are considerably thicker then the rib-weave is produced.

Thus the very large number of variations of methods for interlacing the warp and filling threads makes to weave the wide variety of fabrics each of which has special properties and uses.

The beam of the warp threads is placed at the back of the loom and the threads are drawn from it across the loom from back to front to be wound on another roller. For the weaving of plain cloth, the threads are drawn through the eyes of two sets of heddles.

The filling threads pass over and under alternate warp threads which are lifted and lowered by the corresponding heddles.

Toe cop with the filling threads is placed in a shuttle which is moved or thrown from side to side across the loom. Each pass of the shuttle lays one filling threads. The comb like reed described earlier beats the filling threads tight against the preceeding fill threads, as the fabric is woven it is slowly wound on to a roller in front of the loom.

The following lists includes some of the most common weaves:

1. Plain weave (a) Rib weaves (b) Basket weave

2. Floating weave (a) Twill weave (b) Satin weave (c) Sateen weave.

And its variations

6.2 Knitting

The knittings industry is a unique and distinct part of the textile industry. It is the second important method of making fabrics after weaving. The knit characteristics are

- Bulky with surface effect.
- Loosely knitted or tightly knitted.
- Rib-purl-tricot.

Circular knit: Any fabric produced on a circular knitting machine.

Double knit: A special type of rib knit fabric usually closed stitched with a pattern or design effect, generally thicker, heavier and more stable than jersey.

Difference between Weaving and Knitting

Weaving and knitting are the two most common process of making cloth. Weaving is the process of interlacing two sets of yarn at right angles. This operation is done either on a hand or a power loom. If one set of yarns form loops one loop caught into another and one row of loops hanging on the one below. The cloth is made by knitting.Of these two processes, Weaving is the most common method although new and improved knitting machines make cloth quickly satisfactory and the attractive patterns.

Wales (in knitting's): A series of loops in successive rows lying length the wise of the fabric.

Purl: Purl is actually the opposite of knit.

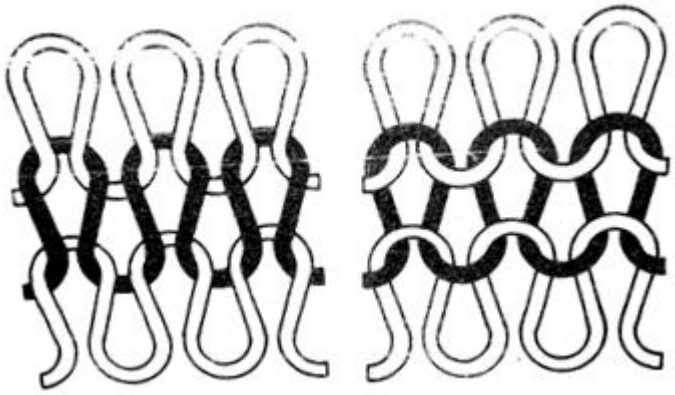


Fig. 6.1 Plain stich and purl stitch

Course: A series of stitches or loops that run cross wise is knitted fabric, corresponds to the fillings in woven goods.

Stitch: A single loop or turn of thread or yarn made by hand or machine in sewing crocheting, tatting , lace making, knitting and knotting.

Jersey: Describes any knitted fabrics where in all of the stitches on one side of the fabric are knit stitches, while all stitches on the reverse side are either purl stitches or a combination of purl tuck and /or miss stitches also known as single stitches.

The knitting industry has two main branches

(a) The knitted yarns goods industry : Which produces the fabric sold to apparel manufactures, sewing centre retail shops and others.

(b) The knitted end produces products industry: Which produces completed consumer products such as hosiery, sweaters, men's T shirts and athletic shirts and others.

Weft knitting: Knits are classified as a) warp knits b) Weft knits.

It is a type of knitting in which yarns run horizontally from side to side across the width of the fabrics.

The fabric is actually formed by manipulating the knitting needles to make the loops in horizontal courses built one on top of another. All stitches in a course are made by one yarn. It is simplest form; a weft knit can be made from one yarn.

Weft knits are made either flat or open width fabrics (like woven fabrics) on so called flat knitting machines.

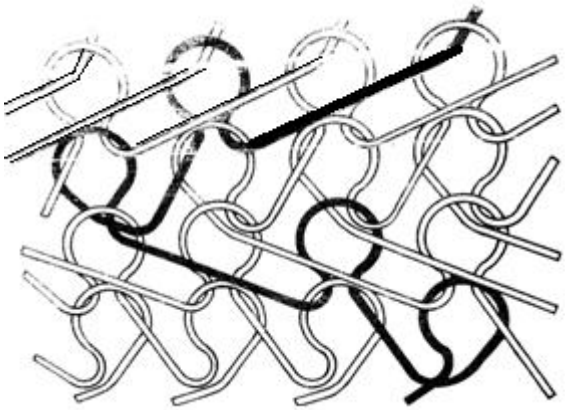


Fig. 6.2 Simple warp knit fabric

Warp knitting: Warp knitting's involves the preparation and use of a warp beam containing a very large number of parallel yarns mounted on the knitting machine. In warp knit fabrics the yarn run the length of the fabrics. The yarn forms the vertical loop in the one course and they move diagonally to the next wale to make a loop in the following coarses. The yarn zigzag from side to side along the length of the fabrics. Each stitch in a coarse is made by different yarn.

Knit fabrics names: Classical knit fabrics are named primarily on the basis of their construction not on the basis of appearance and weight.

Identification of warp knits

Practically all the warp knitted fabrics are identified and distinguished from weft knitted materials by careful observation of the face and back of the fabric

usually with the aid of a pick glass. The face of the fabric has rather clearly defined plain stitches. Generally running vertically but slightly angled from side to side. The back of the fabric has slightly angled but horizontal floats. These floats are called 'laps or under laps' formed from the side ways movement of the warp yarns as the fabric is made, the recognition of laps in a knitted fabric is the most important distinguishing feature.

6.3 Non woven fabrics

Non woven fabrics are made by the any process other than weaving. They are defined as textile materials made directly from fibers and held together as fabrics by different methods. The first non woven was introduced in 1942. There are two generally categories of non woven's 1. Durable 2. Disposable.

Durable: The materials are not manufactured or intended to be thrown away after the single or limited number of applications. Examples include apparel interlining, carpet backings etc.

Disposable: these materials are manufactured with the intention of being thrown away after the single or limited number of applications. Examples include disposable diapers, head rests, surgical gowns, filters etc.

Semi durable non wovens: Some items might be considered as semi durable like hand wipes. The major fiber used in non wovens for the disposable is rayon while the major fibers for durables include rayon, polyster, olefin others used are nylon, vinyl, acrylic, cotton for creating non woven's a web of fibers is first made. This means that fibers are laid by machines in random manner to form this layer called web. Later these webs are laid over each other and are then hold in place by

- Needle punching

- Bonding by means of adhesive heat.

Needle punching is a mechanical process which enlarges the fibers in the web by punching them with needles. This is the most in expensive method such non woven are used in floor covering in filters.

Bonding is a method where 2 or 3 more layers of fiber webs are made to stick to each other by adhesives. These are used in disposable items such as protective gowns, hats etc.

Bonding by means of heat can be done when the fibre webs contain at least 30% fibers. Since these synthetics soften by heat, heat is applied so that the

fibers bond with each others forming a non woven. These non woven provide shape to cut parts of garments. So this webs can be used ad interlinings.

Felting

Wool is a probably most ideal for felting because the fibers swell in moisture, interlock and remain in the condition when pressed and shrunk when the fibers have been selected and if necessary blended with cotton or man made fibers they are cared in to a flat sheet or bat. Bats are placed first one way and then the other layers until the desired thickness is reached. Allowance has to be made for shrinkage because steam and pressure of heavy pressures in the process of felting may increase the bats as much as 20% thickness. To make the felt fabric stronger and more compact the fabrics is placed in warm soapy water where it is pounded and twisted. For heavy felt a weal acid is used instead of warm soapy water. The cloth is then ready for finishing process consisting of scouring, dyeing possibly pressing or shearing and treatment with special functional finishes to make it water repellent moth proof and shrinks create and fine resistant. Felt is made for men and a women's hat's, women's skirts, rests and slipper tables covers. Paddling and lining's woven felts have their place primarily in the industrial field.

Nets and braids

Net in geometrically shaped figured mesh fabric made of silk, cotton , nylon, polyester, rayon and other man made fiber. It comes in different sizes of mesh and in various weights. On the other hand machine made net is closely related to warp knitting because it is constructed on either a tricot or Rachel warp knitting machine. The first nets to be made by machine were the warp knitted tricot that appears about the middle of the 18th century.

Another type of net in the knotted square mesh type with knots with 4 corners to form the mesh. Originally made by hand and used by fisherman it is now made by machine. These modern fish nets of linen cotton by man made fibers are used for glass curtaining in contemporary living rooms, sun porches and dens.

Braids

This is a method of interlacing 3 or more yarns or bias cut strips of cloth over and under one another to form a flat or tabular fabric. These braided textiles bands which are relatively narrow can be used as belts, pull cards for lights and for trimming for uniforms and dress tapes for pajamas' and some shoe laces. Several width of plastic and straw braiding can be sewen together to make hat

shapes similarly by braids of fabrics or yarns may be sewn together to make braided rugs.

Felt: Felt is the oldest known textile. Wool and related animal fibers such as camel, goat, and hair have unique feature of enlargement when subjected to heat, moisture and rubbing agitation. This property is the base of felt fabric.

lt is made directly from fibers treated in machines designed to accomplish the felting action (heat, moisture and agitation). Despite of wool, rayon or cotton can also be used.

Felt does not fray or ravel. It can be blocked to shape in all directions because it has no gain. It has good excellent shock absorbing and sound absorbing tendencies. It has poor drapability and low tensile strength it cannot be torn but only be cut like woven fabrics it has no gain.

Lace fabrics : Lace is a fabric consisting of decorative design created with thread s or yarns on a net like open background. They may be full of fabric width when used in making dresses or evening wear etc.

(a) Trimming laces: A wide variety of patterns available in laces used for trimming. They are produced having narrow width ranging from 1cm or less width. They are available at various costs and available at the range of average consumer. They are used as decorative materials, apparels, household materials.

(b) Nylon net laces: These laces generally contain a net background on which patterns are made. They are machine made, less expensive and are mostly used as curtains.

The elasticity pose difficulty in cutting and stitching. The pattern should be properly placed over the fabric, taking care not to stretch the fabric and while cutting also avoids the stretching of fabrics.

As the lace fabrics are delicate they require gentle handling sewing and care. Hand sewing is most commonly employed as machine pucker the lace and makes it unsightly. Hand washing is mostly recommended to preserve the delicacy of lace fabric. A mild detergent should be employed while washing these fabrics.

It is the most complicated of all textile making processes. They are considered as fabrics of luxury and delicacy though some are machine washable.

The leavers' machine produces the most finest and most intricate of machine made laces. They are of specific style, type or range weight.

Tufted fabrics: It is another type of the pile fabrics not produced by weaving or knitting. Tufted fabrics are produced by needling extra yarn into an already woven fabric of a relatively open weave construction.

Machine for tufting are multi-needle machines and are capable of producing a tufted needle material. They are made only in relatively heavy weight mostly used for carpeting.

Conclusion

The appearance of a garment is greatly influenced by the fabric used for construction not all the garments are suitable by some fabrics. To choose a suitable fabric for a specific end use calls for basic knowledge in fabric construction and types of fabrics available in the market.

Short Answer Type Questions

1. What is plain weave?
2. What are the types of weaves?
3. What is knitting?
4. What are purl fabrics?
5. What is weft knitting?
6. What is warp knitting?
7. What are non woven fabrics?
8. What is jersey knit?
9. What are tufted fabrics?

Long Answer Type Questions

1. Write about classification of knit fabrics?
2. How do you identify warp knit fabrics?
3. Write about needle punched non woven?
4. Write about (a) felt fabrics

   (b) Lace fabrics.

I. Test your understandings

State whether the following statements are true or false

1. Interlacing of warp and filling threads is called weaving. (T/f).
2. The simplest weave is a twill weave. (T/f).
3. The knit characteristics are bulky, loosely knitted, rib pearl tricot. (T/f).
4. Any fabric produced on a circular knitting machine is called a circular knit. (T/f).

II. Test your understandings

State whether the following statements are true or false

1. Non woven fabrics are made by weaving. (T/f).
2. Needle punched non wovens are made by the methods that involves the enlargement of fabrics to hold them together.(t/f).
3. The pressure of air causes mechanical binding is spun laced fabrics.(t/f).
4. Fusible non woven's are made from thermo plastic fibers.(t/f).
5. Felt fabrics have high drapability.(t/f).

Answers for Test your understanding - I

1. True
2. False. (plain weaves).
3. True.
4. True.

Answers for test your understanding - II

1. False
2. True
3. False (friction of water jets)
4. True
5. False

UNIT 7

Looms

Structure

Learning Objectives

After studying this unit, you will be able to

- List out the parts of the loom
- Understand the various steps in weaving
- Know about variations of the plain weaves
- Types of weaves
- understand the twill weave and satin weave
- List out the examples of fabrics for the weaves
- Know about woven fabrics.

Unit Preview

This unit gives the information regarding the weaving process, and the steps in weiving. i.e. different kinds of weaves. It explains in detail about plain weaves and its variations, twill weave and its variation, satin weave and its variations.

7.0 Introduction

The principles of weaving are known very clearly perhaps a long ago as 400BC our ancestors knew how to make baskets and mats by interlacing twigs., reeds, and grasses. Later they learnt how to twist together short fibers, such as wool and cotton, to form yarn and to weave the yarn in to cloth on a loom, primitive looms were built around a convenient horizontal tree-branch, over which the warp threads were tied. The lower ends of the threads were fastened to tie them in position.

Woven fabrics are made from two or more sets of yarns interlaced at right angles to each other the lengthwise yarns are called warp or ends and the crosswise yarns are called weft or filling or picks. Neat firm edges are formed on both sides along the length of the fabric when filling yarn turns at the edges during weaving. They are commonly referred to a “selvedges”.

Weaving is done on a machine called loom. The way filling yarn interlaces with the warp yarns produces designs in woven fabrics. Weaving is the mode of interlacement of filling with warp.

All woven fabrics are based on three types of weaves which are termed as basic weaves. The three basic weaves are plain, twill and satin. Most of the other weave are variations or combinations of these three weaves.

7.1 Parts of the Loom

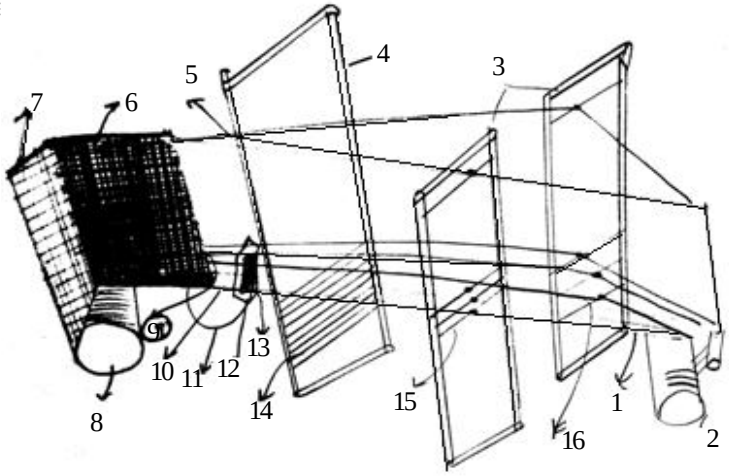


Fig. 7.1 Structure of the loom and its parts

1. Warp yarn
2. Warp beam
3. Harness
4. Batten
5. Reed
6. Selvedge
7. Woven cloth
8. Cloth beam.
9. Fell or edge of the cloth.
10. Shed.
11. Weft.
12. Shuttle.
13. Bobbin.
14. Dent.
15. Heddle.
16. Heddle eye.

Warp Beam

Located at the back of the loom on which with the warp yarns are wound. It is a cylinder on which the warp threads are in parallel lines. The yarns pass to the front of the loom where they are attached to cloth roll.

Harness

This is the frame consisting of a number of wires known as heddles. Each heddle consists an eye through which one or more warp yarns passes. The harness is the important part of the loom as it has upward or downward movement of warp yarn, ensures the correct running of the weft yarn over or below the warp yarn to produce the designed pattern in the cloth. Harness contains a number heddles.

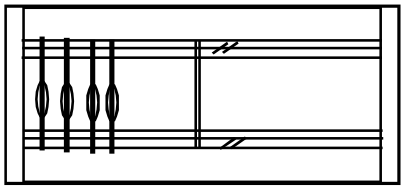


Fig. 7.2 Harness

Heddle

It is a were with a hole in the center through the warp yarn goes. There are as many heddles as there are warp yarns in the cloth. All the heddles are held in two or more harnesses the warp is raised and lowered by a harness-haddle arrangement. When the harness is raised shed is formed through which the filling yarn can be inserted.

Fig. 7.3 A Heedle

The Weaving Process

The first step in weaving is to stretch the warp or longitudinal yarns. ,which must be very strong. The weft, woof or filling crosses the warp, binding the warp threads at either side form the selvage. The three essential steps after the warp is stretched are shedding or raising every alternate warp yarn or set of yarns to receive the weft, picking or inserting the weft and battening or pressing home the weft to make the fabrics compact. In most primitive weaving these operations were performed by the hands alone as in making rush mats and baskets Gradually, frames for holding the warp evenly stretched and devices for throwing the weft came into use.

Shuttle

This holds the filling or the weft yarn and is passed backwards and forwards across loom.

Fig. 7.4 A Shuttle

Reed or Batten

It is a frame which is located directly in front of the harness.

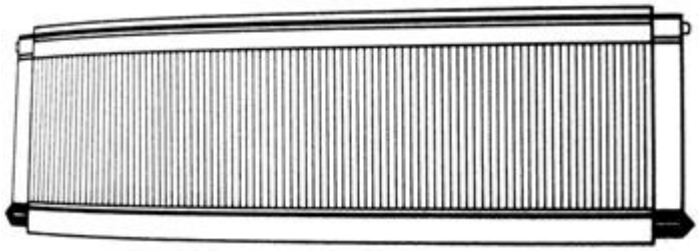


Fig. 7.5 A Reed

This frame pushes forward each time the shuttle passes in between the warp yarns and presses back the filling thread in position.

Cloth Beam

It is located in the front of the loom nearest to the weaver on the which the woven cloth is wound.

Step in Weaving

1. **Shedding :** Raising one or more harness to separate the warp yarns and formation a shed.
2. **Picking :** Passing the shuttle through the shed to insert the filling yarn.
3. **Beating up :** Pushing the filling yarn into place in the cloth with the reed.
4. **Let off :** Warp yarns are released from the warp beam so that weaving may be carried out.
5. **Take up :** Winding of finished cloth on the cloth beam

7.2 Characteristics of Woven Fabrics

S**elvedges**: In most of the materials the edges, which are known as selvedges, are made with heavier and more closely placed warp yarns. Selvedges is generally ¼ to ¾ inches wide on fabrics.

The yarns are usually the same as those in the rest of the fabric except that they are made firmer and stronger by increasing the size or count of the way yarns in selvedge. Fused selvedges are found on fabrics made from the heat sensitive fibre. The application of heat melts and then seals the fibre together at the edges.

Count of the Cloth : Count is the technical term used to indicate the number of warp and the weft (the filling yarn or picks) in one square inch of fabric as it comes from the loom. If warps are 90 and the wefts are 80, the count written as 90 x 80 and a fabric in which the warp yarns and weft yarns are more in number it is called as high count fabric. A very low count fabric is one in which the warp and the weft yarns number 28 and 24 respectively example in surgical gauze. The exact number of warp and the weft yarns in a square inch of fabric can be counted with the help of an ordinary magnifying glass held over a tightly stretched piece of cloth. But all this is not necessary if the aim is only to judge whether the cloth is of a high or low count. If the weave is a very close one and tiny spaces are visible between the weave and the cloth it could be a closely woven fabric.

If the fabric is held against the light, the closeness of the weave or its porosity can be easily observed. Thread count is an indication of the closeness of weave and can be used by the consumer in judging quality, ravelling, durability and potential shrinkage. Fabrics with close weave generally shrink less.

Balance of cloth

Low count fabrics are woven with a fewer interlacing per square inch to make the fabric light-weight. Due to this a porous structure is formed. The balance of fabric is determined by the proportion of warp yarn to weft yarns. If the number of warp and weft yarns is nearly the same in a square inch the fabrics have a good balance for a example, gingham with a count of 96 x88 and guage with the count of 28 x 24 are material with a good balance but the shirting with 100 warps and 50 picks has a poor balance. A fabric with a poor balance when held against the light will show more yarns running in one way that is length wise only. Such a fabric is not good as it does not stand hard, wear and many washings. The strength of the fabric can be tested by tightly holding and stretching a piece of fabric, and rubbing it repeatedly using thumbs. If any yarn slips out its place and the tiny spaces between the weave gets enlarged, it indicates that the fabric is not as strong as it looks.

Yarns

Warp and filling have different characteristics and the fabric performs differently in the warp and filling direction. Stronger yarns are used in the warp-wise direction as they undergo more tension and friction than weft yarns.

Most fabrics stretched less in the warp direction. Warp yarns lie straight in the fabric because of loom tension. They show less crimp. Warp yarns tend to be stronger with higher twist. Decorative or special function yarns, yarns with slack twist, yarns with little twist are usually the filling yarns.

Grain

The grain indicate the direction of the warp or weft yarns. Length wise grain is a position along the warp yarns and parallel to selvedges crosswise grain is along the filling yarn.

Weaves

Weaves are named according to the system or design followed in interlacing warp and weft yarns. The basic weave used in fabric construction are: Plain weave, Twill weave and Satin weave. These are the foundation weaves and form the basis of all other types of weaves.

Plain weave

Plain weave is the simplest of all the weaves. About seventy percent of the woven fabrics available in the market today are woven in plain weave or it variations. It is formed by interlacing warp and filling yarns in a pattern of over one and under one. (fig-1) In the first row the filling yarn moves over the first warp yarn and under the second, over the third, under the fourth and so on. In the second row, the filling yarn moves under the first warp yarn and over the second warp yarn. These two rows are repeated to get the pattern of plain weave.

Plain weave fabrics have no right or wrong side. Plain weave provides a wide scope for introducing variations in the fabrics by use of yarns of different colours, different textured yarn and also by use of thick and thin yarns. Fabrics can be produced in large variety, with different degrees of yarn twist and with different degrees of tensions in the loom. Fabrics made by tightly twisted warp and loosely twisted weft make it easy for a napping finish to be given to it. Example: flannelettes, striped material, plaids are made by using different coloured yarns at intervals eg. ginghams.

Plain weave is made interesting by printing and embossing. Plain weaving also allows the use of many different finishing processes to produce varieties and different styles of fabrics.

Plain weave is used in the construction of the fabrics from almost all the textile yarns cheapest to produce. It is the most serviceable of all weaves as fabrics,with this weave are easy to wash, dry clean, wear well and are comparatively inexpensive.

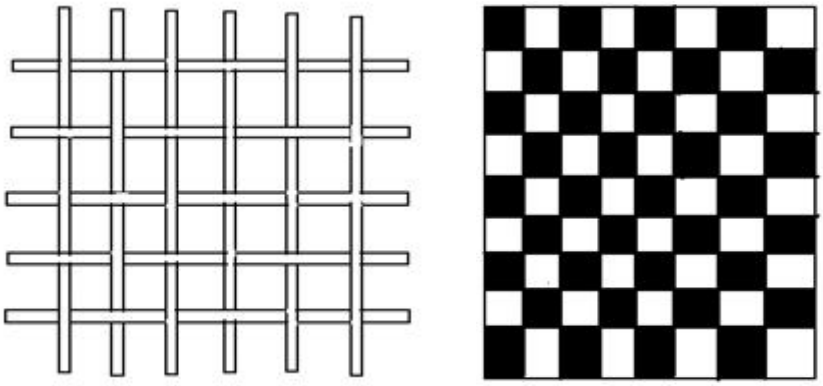


Fig. 7.6 Structure of Plain weave

Plain weave fabrics

Cotton : Calico, cambric, canvas, cheese cloth, chintz, cotton, crepe, flannelette, gingham, long cloth, muslin, organdy, seersucker and voile.

Linen : Cambric, dress linen, hand kerchief linen and toweling

Wool : Crepe, Flannel

Silk : Chiffon, crepe de chine, crepe georgette, taffeta and voile.

Rayon : Chiffon, crepe, georgette, seersucker, organdy, taffeta and voile.

Plain Weave Variation

Rib weave : It is the variation of the plain weave. In this heavier yarns are used is the warp than those is the weft and this produces a ribbed effect. Some times the order is reversed and the heavier yarn is used in the weft. Eg. Faille grass grain, broad cloth, poplin are some of the examples.

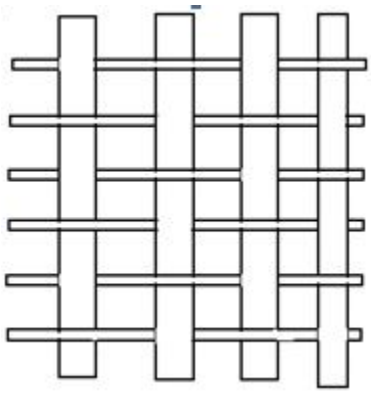
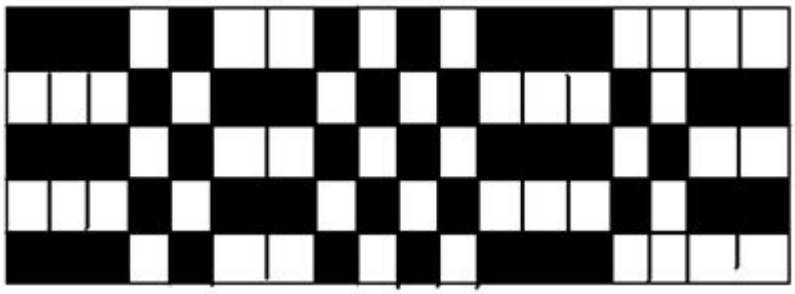


Fig. 7.7 (a) Rib Weave



(b) Rib Weave

Basket Weaves

Basket weaves is a balanced weave. In this two or more yarns in both warp and filling are treated as one and interlaced as in plain weave. The fabric with basket weave have. Flenth and if the count is not very high the fabric is even porous and pliable. However, fabrics with arrangements such as 3x3, 4x4, 6x6 snag easily. This weave is used in material for sports coats and suits. This is a comparitively loose weave and therefore the fabrics are more likely to shrink.

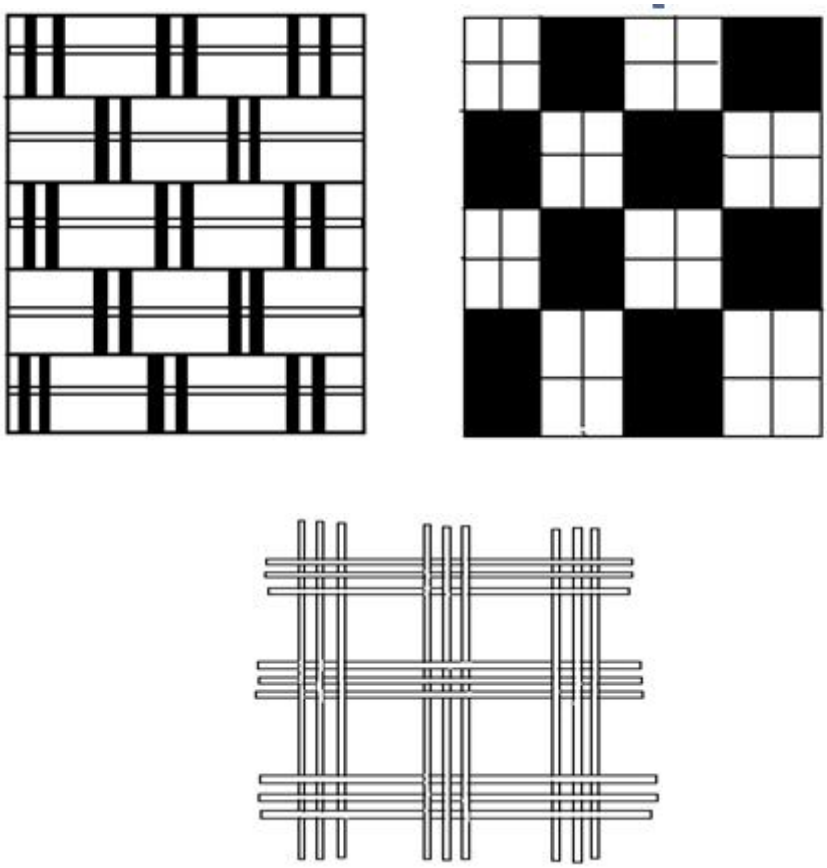


Fig. 7.8 Basket Weave

Twill weave

This weave forms Wales diagonally across the face of the cloth. This is brought about by the interlacing of warp and filling yarns with a progression of one at the point of interlacing

Example : If the first filling covers warp yarns 2,3,4,5,6,8 and 9 goes under 1,4,7, then the second filling will go over 1,3,4,6,7,9 and 10 and then goes under 2,5,8, and so on. The simplest form of the twill weaves is made by throwing the filling yarn over a two warp yarns, then under one, over two under one and so on. At least three harnesses should be used in the loom to weave the fabric. The direction of diagonal in the weave can be created from right upper hand or left upper hand called as right hand left hand twills respectively.

A variation of this weave is "Herringbone" structure . In this the diagonal direction is purposefully reversed creating a design resembling the backbone of fish. Thus it is termed as herringbone.

Another variation is made from a diamond pattern. Variations are also introduced by using yarns of different sizes, qualities and colours. Twill weave has fewer point of interlacing than plain weave. So it permits closer packing of warp yarns to produce heavier fabrics which results in longer wear.

Twill weave produces strong material because of the tightly yarns which are used to bring out the diagonal effect and the compactness of its construction. Twill weave fabrics are mostly expensive because of their elaborate construction on but they are strong, stand hard and long wear. This weave is generally used in wool and cotton fabrics where durability is a prime necessity. Twill weave fabrics do not show dirt or dust as much as the fabric woven in plain weaves do and are therefore more suitable for dresses, men's shirts and suits and children garments.

The side on which diagonal effect is more prominent is the right side of the cloth. But when twill-weave fabrics are finished by "napping" the napped side is the right side.

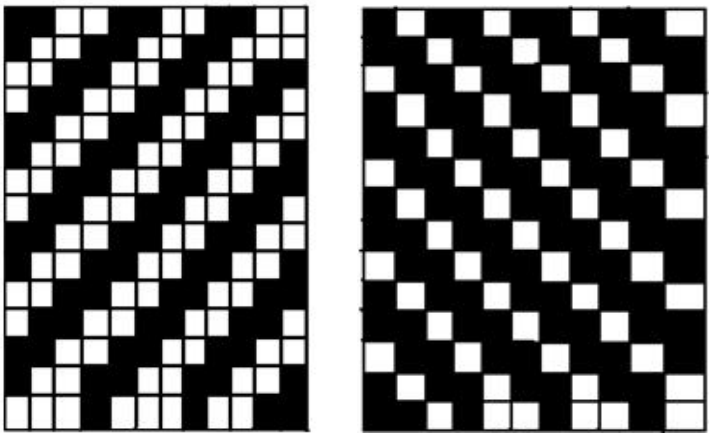


Fig. 7.9 Twill weave

Twill Weave On Fabrics

Cotton : Denim drill, gabardine, jean, khaki, serge.

Linen : Table linen, towels, drills, and ticking

Wool : Broad cloth, cash mere flannel gabardine, tweed, serge, worsted

Silk : Twill, serge.

Satin Weave

Satin weave fabrics are characterized by lustre and smooth surface. They are similar to twill fabrics except that the floats are long and diagonal lines are not visible.

Satin weave is one in which each warp yarn floats over four or more number of filling yarns and go under one fifth yarn with a progression of interlacement by more than one, thus avoiding the formation of the diagonal lines which will interfere with the lustre of the fabrics. The longer floats permit closer package of yarns and thus satin fabrics normally contain more number of yarns than plain weave fabrics.

Satin fabrics have a right and wrong side. A high count of yarns in the fabric provides strength, durability, body and firmness. Their smooth surface provide more lustre. Low count fabrics are not durable and tend to ravel more.

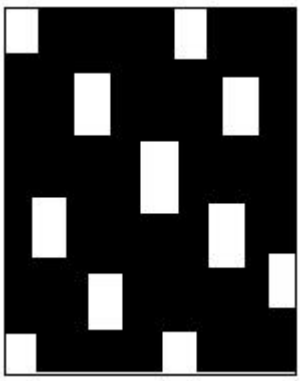


Fig. 7.10 Four float satin weave

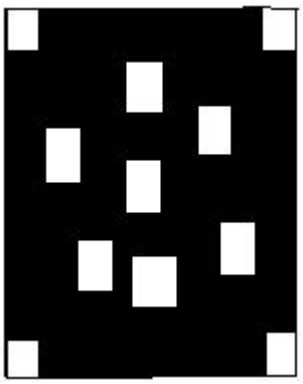


Fig. 7.11 Seven float satin weave

Sateen Weave

A variation of satin weave is sateen weave. It is characterised by having filling yarn floats on the surface. These are less lustrous and less durable as filling yarns are generally weaker compared to warp yarns.

Fabrics in Satin weave: Washable satin, satin crepe, slipper satin etc.

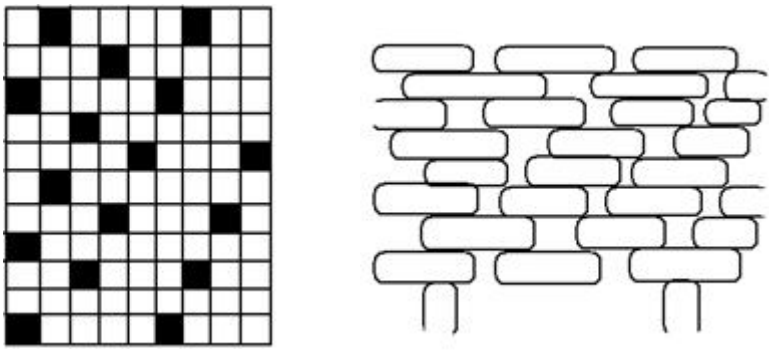


Fig. 7.12 Sateen Weave

Suitability of Weaves Various End Uses

When suitability is a major factor, the consumer should carefully consider the end use or the purpose for which the fabric is to be used Plain weave fabrics are firm and considered to be more serviceable as they are laundered or dry cleaned, comfortable to wear and convenient. They are versatile, ranging from light weight fabrics to heavy weight fabrics.

Light weight or sheer fabrics are suitable mainly for children's dresses, blouses, summer shirts, sarees and glass curtains, medium weight fabrics are mainly used for shirt, women dresses, pyjamas and aprons. Heavy fabrics are used for upholstery materials, suiting etc.. All plain weave fabrics are easily sew able and are excellent for creating styles through mix and match.

Ribbed fabrics are suitable mainly for furnishings and basket weave fabrics are suitable for shirting's and furnishings.

Twill weave fabrics have interesting surface due to diagonal lines on the surface and are also durable. They do not show much soil and required only little ironing. So they are suitable for work and sports clothes.(They are mainly used for menswear even in wool.).They keep up the shape well and so are excellent for suitings.

Satin fabrics are not suitable for daily wear due to the presence of long floats. They can be selected for occasional evening wear for women appearance and style govern the satin, hence they are more expensive. They are considered to be best lining fabrics for coats and shirts because they slide easily over other fabrics.

Conclusion

A brief study of weaves enable a garment designer to choose suitable woven fabrics for different styles. Plain twill and satin are the weaver that form the basis structure in all fabrics plain weave being simple and inexpensive forms a good background for printing. Twill weave produces durable fabrics. Satin weave produce smooth, lustrous fabrics that are suitable for linings

I. Test your Understanding

State whether the following statements are TRUE / FALSE

1. Twill weave forms waves diagonally across the face of cloth (T/F)
2. Examples of twill weave are Gabardine, Jean (T/F)
3. Satin fabric is not lustrous and not in smooth surface (T/F)
4. Sateen weave have the filling yarn floats on the surface (T/F)
5. Sateen fabrics are suitable for daily wear (T/F)

Multiple Choice

Pick up the correct answer from the following questions:

1. One of the steps in weaving are

   a. shedding b. warp c. weft d. grain.

2. Edges are known as

   a. count b. balance of cloth c. yarn d. selvedge

3. Basket weave is a

   a. Balanced weave b. rib weave c. satin weave d. twill weave.

4. Satin weave fabrics are characterized by

   a. rough b. float c. yarn d. luster

5. Twill weave fabrics are mainly used for

   a. children's wear b. ladies wear c. men's wear d. instant

Short Answer Type Questions

1. List out the basic weaves with 2 examples each?
2. what are the variations of plain weave?
3. which is the strongest of all basic weaves? Why?
4. List out the characteristics of satin fabrics?
5. write about basket weave?

Long Answer Type Questions

1. With neat labeled diagram draw the parts of loom?
2. what are the steps in weaving?
3. what are the characteristics of woven fabrics?
4. what is a weave? Describe plain weave with neat diagram?
5. Describe twill weave and its variations?
6. Describe satin weave and its variations?

Answers or test your understanding - I

1. True
2. True
3. False- luster and smooth surface
4. True
5. False- not suitable

Answers for Multiple choice questions

1. a. shedding
2. b. selvedge
3. a. balanced weave.
4. d. luster
5. c. men's wear

UNIT 8

Stains

Structure

Learning Objectives

After studying this unit, the student will be able to

- Explain the definition of satin.
- List out the various types of stains
- Understand the general rules to be observed in removal of stains.
- Know about common stains and the reagents required for removal of stains on various fabrics.

Unit Preview

This unit helps in understanding the stains, the general rules to be followed for removing the stains, reagents which are required to remove stains and different methods for removing thestains from thefabrics.

8.0 Introduction

Stain is spot or mark of discolorations on fabrics by the contact and absorption of foreign substances.

The need to clean and care for a household is always with us. For a successful stain removal prompt action is important as a quick deal with a stain is more likely to remove it simply. With most stains, try cold water first, flushing the water through the material if possible. Make sure that the cleaners used are known and awareness of there is also known. But as a general rule, if one can safely eat it. For example lemon juice and bicarbonate of soda it is environmentally kind as a cleaner.

Stain removal and spotting is a skill which calls for experience and demands special attention. The essential factors to be kept in mind while removing stains are:

(1) The composition and colour of the fabric.

(2) The nature and age of the stain.

The stain removal is a major store filled with different formulae designed to remove our stains in daily life. It is a great asset to the cleaning solutions tackling everything to wipe out daily stains. These stains with their respected removing reagents are specified in the given chapter. Thus the students can obtain maximum knowledge regarding the stains and their methods of removals.

8.1 Classification of Stains

Broadly speaking stains are divided into

(a) Animal

(b) Vegetable

(c) Greece

(d) Dye

(e) Mineral

Animal stains are those caused by blood, egg, milk, meat and juice. As these contain protein matter heat must be avoided in removing them. Otherwise the protein matter gets fixed to the stain.

Vegetable stains include those caused by tea, cocoa, coffee, fruit and wine. These are acidic and therefore require alkaline reagents to remove these stains.

Greese stains may be just greese spots or some coloring matter fixed with greese. These include butter curry, oil paint, varnish and tar stains. In removing these stains some greese or an absorbent is first used to dissolve or absorb grease before the removal of the coloring matter. A solvent soap is also very effective for removing these stains from washable fabrics.

Dye satins may be acidic and so that the nature of the stain is ascertained before a specific removing reagent is used.

Mineral stains such as iron mould, black ink and certain medicine stains are compounds of a metal and dye. These are first treated by acid reagent to act on the metal and then by an alkaline solution to neutralize the acid reagent and act on the dye.

8.2 General rules to be observed in removal of the stains

1. All the stains are easily removed when fresh.
2. If the nature of the stain is unknown it should be treated by the least harmful methods first going one process to the next until an effective agent is reached.

They are as follows:

(a) Soak in cold water.

(b) Soak in warm water

(c) Bleach in open air, if time permits.

(d) Treat with an alkaline solution

(e) Treat with an acid solution.

(f) Treat with oxidizing bleach.

If the above methods fail

(g) Treat with reducing bleach.

(h) In the event of stain persisting which is unlikely treatment with alkaline solution or with reducing bleach can be repeated.

(i) Known stains should be treated with their specific reagents.

(j) Bleaching treatments should be tried as the last resort as these should be taken from several applications of weak solutions rather than the use of strong solution in one application.

(k) Reagents may be spread on to cotton and linen fabrics and boiling water may be poured through the fabric.

8.4 Common stains

(a) Ball pen

Reagents required : Methylated spirit

Method: Rub lightly with methylated spirit, swab with methylated spirit using a pad of blotting paper below. Same method for a cotton, linen, silk, wool, and synthetics fabrics.

(b) Boot polish

Reagents required : Methlated spirit

Method: Boot polish is made by dissolving certain colors in wax. The wax is removed by means of solvents. This will also remove the color. If the color still remains treatment with methylated spiritwill completely remove the stain.

(c) Blood

Reagents required : Cold salt water, hydrogen peroxide.

Method: A fresh blood stain on clothing can be rinsed out in cold salt water. If the satin is dried bleach with a drop of hydrogen peroxide.

(d) Gum and glue stains

Reagents required: Glycerin or acetic acid or methylated spirit or hot water.

Method: Treat with hot water to soften and dissolve the stain. The addition of a few drops of glycerine will assist in dissolving the stains in some cases otherwise few drops of acetic acid also will help.

(e) Stained brass

Reagents required: Lemon sprinkled with salt. olive oil.

Method : A greener way is to rub with a piece of lemon sprinkled with salt or the other is rinses with dry then rubs with the olive oil.

(f) Greese or oil

Reagents required: Greese solvent, French chalk or fullers earth powder.

Method: If the satin is fresh wash with hot water and soap and if it is dry treat with greese solvent and wash with hot water and soap for the white cotton and linen.

French and fullers earth are sprinkled on the stains to absorb the greese then wash it with water.

For unwashables

Treat with greese absorbents spread French chalk or alkalies earth on the stain leave it for one hour brush off the powder.

Butter

Reagents required **:** Absorbent paper

Method : Scrape off as much as one can. Iron with warm iron between layers of absorbent papers.

Lipstick

Reagents required: Bleaching powder, methylated spirit kerosene or turpentine.

Method : Steep in methlated spirit and wash with solvent soap. Moisture and soften by working with glycerine. Leave it for short time and then wash with soap or surf. For synthetics fabrics steep in kerosene or turpentine wash with soap and hot water. Better try cold water first and then wash in warm to soapy hot water.

Candle wax

Reagents requires: Blotting paper

Method : Put in plastic bag in the freezer for sometime scrap it or sodified it. Then place fabric between sheets of blotting paper and iron with a warm iron.

Marking ink

Reagents required: Iodine solution, sodium thiosulphate, salt. Tomato, sour milk or curd, salt and lie juice.

Methods : Rub the stain with cut tomato and wash. Steep in iodine solution and then by steeping in sodium thiosulphate solution and wash. Bleach according to the fabric. Rub salt and wash repeat till stain is removed.

Mildew

Reagents required : Javelle water, potassium permanganate, oxalic acid.

Mildew is formed by the growth of fungus on the damped fabrics

Method: (a) Bleach by sunlight

(b) Bleach by Javelle water.

(c) Bleach by potassium permanganate.

(d) Bleach with hydrogen peroxide.

Potassium permanganate for cotton and linen: Dissolve one ounce of permanganate crystals in one gallon of water.

Mildew on silk and cotton: Take half of permanganate crystals inn gallon of water. Steep materials for 5 minutes till it becomes dark brown and then remove the brown stain by applying any one of the following dilute solution of sulphuric acid or oxalic acid or acidified hydrogen peroxide. Rinse thoroughly in three changes of water and wash according to the type of material.

Mildew on cotton: Apply soap lather on the stains and cover it with French chalk and place it in the sun to bleach. Repeat the process till the satin is almost removed then treat iot with lime juice wash with javelle water.

Preparation of javelle water or hydro chlorite. This can be prepared and stored

Washing soda = 500grams

Boling water = 1 liter

Chloride of lime = 250 grams

Cold water = 2 liters.

Method: Make a solution of washing soda and boiling water mix chloride of lime with cold water stand the mixture for some time so as to settle down decant a clear liquid and add it to washing soda solution. This will give sodium hydrochloride and calcium carbonate will precipitate. Allow the precipitate to settle and then stain off the clear liquid. This must be stored in colored bottles as it deteriorates in the light.

Some procedure for colored cotton, silk, wool and synthetic.

Jams and stains

Reagents required: Borax solution.

Method : Remove jam stains from washable clothes by soaking in a solution of borax and water then wash as usual.

Tar

Reagents required: Oil, greese solvent, kerosene

Method : Spread a little on the stain, let it dry and repeat until the mark disappears.

1. If necessary scrap first.
2. Rub with oil or grease using a clean cloth and working from edge of the stain to the centre.
3. Treat with grease solvent.
4. Treat with kerosene.

Chewing gum

Reagents required : Ice pack

Method : Put the garment in a plastic bag in the freezer for a whole or put a ice pack in the gum. Crack off the solid pieces. Sponge the remainder with dry cleaning fluid.

Iron stains

Reagents required: Toothpaste

Method : To clean the outside of yours iron use tooth paste as iron tools.

Tea and coffee

Reagents required: Borax, washing soda, javelle water.

Method : For fresh stain (cotton and linen):

Pour boiling water through the stain for dry stain:

1. Steep in boiling water containing soda or borax or both or apply glycerine and steep in hot water soda solution.
2. Bleach with javelle water.
3. Bleach with sodium per borate.

For silk and wool fabrics

For stain: Steep in warm water, repeat till satin is removed.

Dry stain

1. Apply glycerine and steep in warm borax or weak ammonia solution.
2. Use hydrogen peroxide bleach.
3. Use hydrosulphite bleach.

Chocolate

Reagents required : Boiling water, detergents.

Method : On clothing scrape off the solid chocolate with a blunt knife. Pour boiling water from a height or use detergent and work from back of stain.

Hair dye

Reagents required : Cold water, liquid detergent ammonia.

Method : Rinse fabric immediately with cold water then wash in warm water with liquid detergent and ammonia.

Curry

Reagents required : Methylated spirit, diluted ammonia or white spirit.

Method : Soak stain with methylated spirit, diluted ammonia or white spirit

Ointment stain

Reagents required : Dry cleaning solution, Liquid detergent.

Method : Try dry cleaning solution, then rinse in cold water then work in liquid detergent and rinse again.

Pan

Reagents required : Pottassium permanganate solution, sodium per borate, hydrogen peroxide.

Method: Treat with potassium permanganate

Treat with sodium perborate.

Treat with hydrogen peroxide and then wash with soap water.

Medicine

Reagents required : Oxalic acid, methylated alcohol.

Method: 1. Steep in warm water.

2. Steep in oxalic acid.

3. Steep in methylated alcohol or surgical spirit.

Egg

Reagents required : Soap and warm water.

Method : Wash in cold water and then in warm water and soap. Apply salt and pour warm water.

Rust

Reagents required : Oxalic acid, dilute borax solution, salt and lemon.

Method :1. Steep in oxalic acid and then rinse with dilute borax solution.

2. Steep in solution of salt and lemon.

Scorch

Reagents required: Dry borax, Wet muslin ammonia.

Method : Bleaching in the sunlight is best. Applt soap lather to stain and place it in the sun. Keep the stain with moisture and while it is in the sun.

Rub with dry borax and wet muslin over stain.

Steep in dilute ammonia place the stain in the sun for bleaching.

Nail polish

Reagents required: Acetme

Method : Apply to the stained area with a cotton wool pad this must not be used on acetate rayon fabric.Ice cream:

Reagents required: Petrol or carbon tetrachloride, borax.

Method : (a) Wash in cold water and soap.

(b) Steep in warm borax solution.

(c) Sponge with petrol or carbon tetrachloride.

Perfume

Reagents required: Ethyl alchohol, Hydrogen peroxide.

Method: (a) Treat with ethyl alchohol.

(b) Bleach with hydrogen peroxide.

Turmeric

Reagents required: Hydrogen peroxide, sun and grass.

Method : Soak in hot soap water and dry in sun or the grass.

Apply a few drops of hydrogen peroxide leave for few minutes, rinse thoroughly and dry in the sun.

Conclusion

The process of removing each satin with reagents suitable to the fabrics is important. The reagents should not damage the fabric. Hence correct procedure should be followed to remove the satin from the fabric and at the same time retainingf the original texture of fabric.

Stain	Condition	White cotton and linen	Silk	Synthetic fibre
1.Blood	Fresh	Soak in cold water and wash in dilute ammonia.	Sponge with cold water.	Wash in cold water
	Dry	Soak in cold water and salt	Same as white cotton for unwashable fabrics apply starch paste.	
2. Butter	fresh	Wash with warm soapy solution	1.Same as cotton use French and clean with blotting paper. Iron by hot iron. 2. Cover by solvent soap.	Cover the satin with French chalk place the stained portion between clean blotting paper.
3. Curry	fresh fresh Freshdry	1. Wash with soap and water. 2. Bleach in sunlight and air. 3. Bleach with javelle water.	1. Treat with solvent soap. 2. Treat with potassium permanganate and ammonia.	1. Wash with soap and water. 2. Bleach with sodium perborate.

4. Dye	Fresh Fresh dry	1. Steep in water 2. Wash with soap and water. 3. Treat with alcohol and dilute acid or bleaching powder.	1. Treat with alcohol or ammonia. 2. Bleach with hydrogen peroxide.	1. Wash with water and soap. 2. Treat with diluted bleaching powder.
5. Egg	Fresh Dry	1. Wash in cold water and then in warm water and soap.	Same as cotton	Same as cotton.
		2. Apply soap and then warm water.	Steep in salt solution	Steep in salt solution.
6.Turmeric (Haldi)	Fresh	1. Same as curry stain	Same as curry stain	Same as curry stain
7. Ice cream	Fresh	1. Wash in cold water and soap. 2. Steep in warm borax	1. Wash with cold water and soap. 2. Add ammonia to soap.	Same as cotton.
8. Ink	Fresh	1. Apply salt and lime juice and leave for some time 2. Soak in sour milk and curd.	Treat with sour milk or curd for white cotton	Same as silk or wool.

9. Ball point ink	Fresh	Swab with methylated spirit using blotting paper.	Same as cotton	Same as cotton
10. Iron rust	fresh and dry	1. Steep in oxalic acid and then rinse in borax 2. Steep in solution of salts and lemon.	Same as cotton	Same as cotton
11. Lip stick	Fresh and dry	1. Steep in methylated spirit wash with solvent soap. 2. Use glycerine and rinse	Same as cotton	Same as cotton.
12. Medic-ine	Fresh and dry	1. Steep in warm water. 2. Steep in oxalic acids and wash with borax. 3. Steep in methylated alcohol or surgical spirit.	Same as cotton	Same as cotton
13. Mildew	Fresh and dry	1. Bleach with javelle water. 2. Apply soap lather and cover with French chalk and place in sun to bleach	Bleach with hydrogen peroxide	Bleach with hydrogen peroxide

14. Nail and varnish	Dry	Apply acetate to stained area with a cotton pad.	As cotton	As cotton
15. Oil and paint	Dry	1. Steep in turpentine wash with solvent soap. 2. Steep in alcohol and then in solvent	Same as cotton	For rayon alcohol is not used.
16. Per-fume		1. Treat with ethyl alcohol. 2. Bleach with hydrogen peroxide	Same as cotton	Bleach with sodium perborate.
17. Scorch		1. Rub with borax and wet muslin over the stain. 2. Steep in dilute ammonia place the stain in sun for bleaching.	Same as cotton	Same as cotton.
18. Shoe polish		1. Scrape of the stain if dry apply little grease wash with soap and water. 2. Steep in turpentine wash with solvent.	Steep with alcohol wash with solvent	Steep in kerosene and turpentine and wash with solvent
19. Tea and coffee	Fresh and dry	(a) Pour boiling water 1. Spread borax and pour boiling water. 2. Keep in glycerin until stain is removed.	Steep with borax solution Treat with hydrogen peroxide.	Same as silk.

Test your understandings

State whether the following statement is true or false

1. Stain is a spot left on fabrics (t/f).
2. Stains are divided into 7 types (t/f).
3. Examples of animal stains are blood and egg (t/f).
4. Examples of vegetables stains are milk and meat (t/f).
5. All stain are easily removed when dry(t/f).
6. Ball pens can be removed by methylated spirit (t/f).
7. Boot polish stain can be removed by water (t/f).
8. Marking ink can be removed by iodine solution (t/f).
9. Tar can be removed by grease solvent (t/f).
10. Tea and coffee can be removed by borax (t/f).

Short Answer Type Questions

1. What is a stain?
2. What reagents are required for removing a) Ball pen b) Tar
3. How do you remove lipstick stain from cotton fabrics?
4. Write the steps involved in removing the mildew stains?

Long Answer Type Questions

1. What is a stain? Explain the classification of stains with examples?
2. What are the general rules to be observed in removal of stains?
3. List out any four common stains and their removing agents?

Answers for Test your understanding

1. True
2. False-5 types
3. True
4. False-coffee, tea, cocoa, etc
5. False- when fresh or wet
6. True'
7. False-methylated spirit
8. True
9. True
10. True

UNIT 9

Finishes

Structure

Learning Objectives

After studying this unit, the student will be able to

- Explain the meaning of finishes.
- Identify the need why finishing process is required.
- List the various finishing process for fabrics.
- Understand the effect of calendaring in fabrics.
- Understand the procedure of singeing.
- Importance of tentering is required for fabric.
- Reason for silky lustre and beautiful sheen is seen in cotton fabrics.
- Importance of bleaching and its use.

- Distinguishing the bleaching agents.

Unit Preview

This unit helps in understanding the different fabric finishing process. The finsihing processes includes Calendring,, Signeing, Tentering, Mercerising and Bleaching.

9.0 Introduction

Finish is defined as anything that is done to fibre, yarn or fabric to change its appearance. The finish often determines the fabric care required. Finishing alters the surface of a fabric and therefore its look and feel. Ffabrics or garments generally have to be finished to make the material presentable and attractive. It is often the finish which increases the sales value of the textile goods finish is usually applied to fabrics.

As yarn and fabrics comes from the spinner weaver and knitter they are often in unfinished condition. The material may be harsh to handle and contain impurities either those added to facilitate the manufacturing process or impurities which are natural to fabrics. The material may also be soiled and have oil stains. In fact, materials fresh from their manufacture are referred to as being in a grey or brown state. The finishing processes are required make the materials attractive they also improve their serviceability.

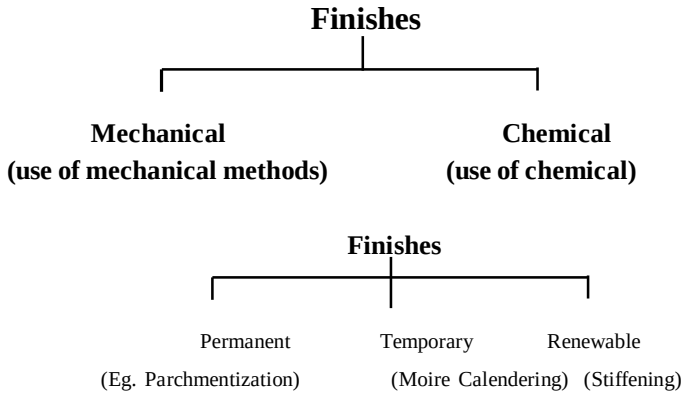
Classification of finishes

Finishes are classified on several basis the newly constructed fabrics as they come out of the loom are called grey goods. This does not mean that the colors of the fabrics is grey, but it simply means that any unfinished fabric must pass through various finishing process to make them suitable for end use. The aims of the finishing process are:

1. To make the material attractive.
2. To improve suitability and utility.
3. To produce variety.
4. To give weight.

Finishes are classified in to two types

1. Mechanical
2. Chemical



Dyeing is sometimes considered part of the finishing process. It can be sometimes be carried out at the same time that the fabric is straightened and brought to its desired finish, width and length for other processes, the fabric must be dried first and then lightly damped for the final finishing treatment. The most common finishing process are listed below. The list is not a sequence nor all are the processes used on all kinds of fabrics. Some fabrics go through more than one process while each fabric is given its own characteristic finish.

9.1 Calendaring

Calendaring is essentially an ironic process. Most fabrics(and yarns too) become stiff board like when wet and dried under tension. Running the fabric through a calendar removes the stiffness and makes it quite soft. At the same time calendaring flattens the yarns and makes it so lustrous. The process consists of applying a lot of pressure by passing the cloth between cylinders of heavy weight of compressed cotton and steel. Rayon fabrics are not calendared as heavily as cotton or linen, but silk often requires fairly heavy calendaring some calendars use waxy calendars substances to give added luster in addition to friction treatment by steam heated pressure cylinders.

Calendaring flattens and close the threads of the fabric to give it the required smooth feel and appearance. The finish depends chiefly on pressure, temperature and moistures.

9.2 Singeing

The object of singeing is to remove the short fibers from the cloth coming off a loom. The cloth is first passed over one or two stream heated copper cylinders to remove moisture and to raise a nap. The projecting fibres are then

singed(burnt) by passing the cloth over a hot plate or through a gas flame at high speed, leaving the cloth with a smooth surface. It is immediately put into water to remove any sparks.

9.3 Tentering

To bring a fabric to the right width it is passed through a 20-90 feet long tentering machine. The cloth is carried through the machine by two moving chains of clips or pins one on each side which grip the selvedge firmly.

Tentering is an important and necessary operation because the fabric has been pulled in length during bleaching, dyeing and drying and is therefore generally narrower than the required finished length. During the operation the clip chain diverge from the entry end about one quarter or slightly less than the length of the machine. As the cloth is carried forward, gripped on either side it is gradually widened. In order that the stretching may takes place easily, the cloth is slightly dampened or steamed. After stretching it is passed through a hot air chamber to dry and set at this width.

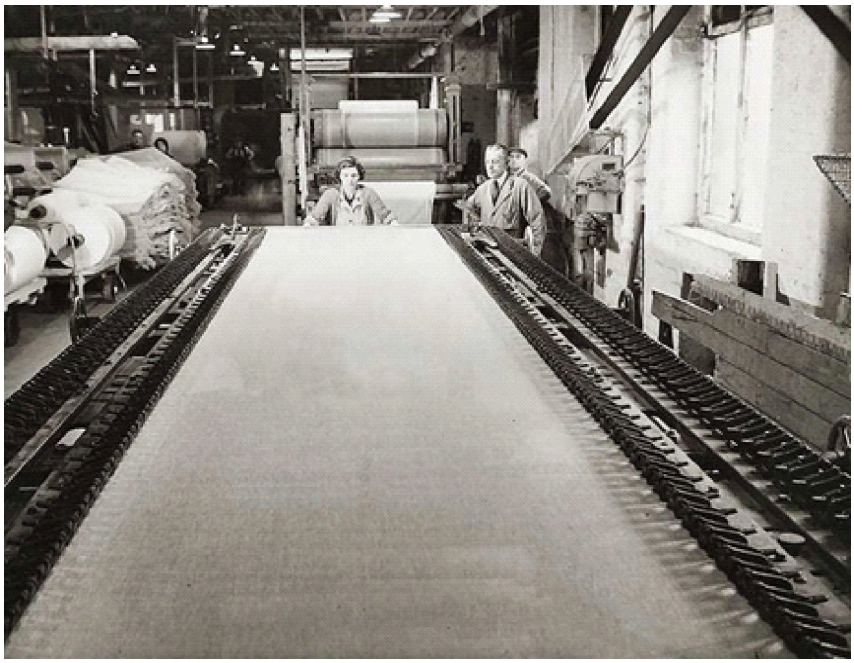


Fig. 9.1 Tentering or Straightening of the fabric

9.4 Mercerising

Applying the caustic soda under controlled conditions gives cotton fabrics a silky luster and beautiful sheen. It also gives the cloth a greater affinity for coloring matters for especially deeper, brighter shades with dye stuff.

The cloth is impregnated with an 18-20% solution of caustic soda for one half of two minutes at room temperatures. The cloth is stretched while saturated and then washed out while it is still in tension. The treatment produces a permanent change in the structure of the cotton fiber.

Types of Calendaring

Variations of calendaring process include the following moireed, embossed and glazed finishes. They are:

1. Moireing : One of the most interesting surfaces is the 'moire' finish. A cloth with a filling wiser rib weave is run between rollers engraved with many lines and thus given a watered effect. On acetate clothes. The finish will remain in good condition after the fabrics are laundered. Rayons are given resin treatment to set the design.

2. Embossing : The fabric is passed between heated rollers that imprint or emboss the design on the fabric. This design is less expensive than a woven design.

3. Glazing : After the fabrics are bleached, dyed or printed they may be given a stiff polished or glazed surface. Starch glue or resin may be used to stiffen the fabric. Then smooth hot rollers that generate friction are applied since the advent of resins in the finishing field permanent finish gaze can be applied to chintz and other muslins.

Finishes that appeal to touch: Some finishes improves the softness of a fabrics. For example softeners' and hard builders must be used on nearly all durable press fabrics. Polyethylene emulsions improve abrasion resistance, sew ability, fabric hand. These emulsions have increased in use as softeners since the advent of durable press. Other finishes gives weight and body still others gives crispness and still others warmth.

Napping : The warmth and softness of wool flannel or a brushed wool sweater is due in part to the fuzzy soft surface called nap. It is the process of raising short fibers of cloth to the surface by means of revolving cylinders with metallic points. Cotton and synthetic fabrics of spun yarns may be napped to resemble wool in texture. Generally yarns used in the fabric should have low twist.

Parchmentizing : These are the permanent finishes on cotton and still remain of great importance. They were discovered by John Mercer in 1844. The higher concentration of the sulphuric acid produces the parchmentising effects. Parchmentising acid probably gelatinizes the surface of the cotton and causes the fibers of cohere some extent.

Burnt out finish : Burnt out finish gives transparent effect possible on blended fabrics only looks different from others. Forms opaque woven designs against a transparent back ground..

Burnt out or etched finish : Etched effects are produced by printing certain solvents on a fabric make of fibers of different fiber groups. For example polyester, cotton or rayon. One fiber will be etched away leaving it sheer as it in itched rayon silk velvet. This results in producing opaques designs against transparent backgrounds.

Thus stiffening the fabric as distinct from the yarns which are also stiffened. Linen like effects are produced, but the acid is rinsed away the fabric is dried on the stenter equipped with jigging motion to breakdown temporary adhesions of the warp and weft at points of intersection. Organdie effects may be produced in this way.

Alterations of the parchmentizing and mercerizing at low temperatures are capable of giving special transparent effects known as swiss finish.

Starch less finish: To reduce the use of starch for a crisp finish that can be durable for repeated washings. Cottons are treated with resins. This starchless finish is permanent and does not dissolves in laundering.

Wash and wear: Permanent starch less finish can be used on curtains, draperies, sheer cottons for apparel. It is used on organdy, lawn, voile and other sheet cottons.

Sizing, stiffing and starching: To increase the weight, body crispiness, stiffness and luster cotton and polyester blends are stiffed. Generally starch, glue, wax, casein, clay etc are used. It is not a permanent finish.

9.5 Bleaching

Bleaches are used to render coloured or discoloured fabrics white. Bleaches are used in laundering to remove stains that do not respond to normal washing. Bleaches should not be used as cleansers. It is not possible to bleach dirty laundry. Bleaching agents can be divided into two classes

1. Oxidizing bleach

2. Reducing bleach.

Oxidizing bleach supply oxygen that combines with stains to form a colorless compound. Normal as well as stained fabrics can be oxidized so the bleach must be in contact with the fabric only till the stain is removed. Longer contact will weaken the fibric.

Reducing bleaches work by removing oxygen from the colouring matter of the stain.

Conclusion

Finishing alters the surface of a fabric and therefore its look and feel. The finishing processes are required to make the materials attractive. They also improve their serviceability. Finishing straightens the fabric and brings it to required dimensions.

I. Test your understandings

State whether the statement is true or false

1. Calendaring is an ironing process. (T/F)

2. Singeing removes the short fibers from cloth. (T/F)

3. Tentering is not a finishing process. (T/F)

4. Caustic soda is used in mercerizing to give silky luster to fabrics. (T/F)

5. 5-10% of caustic soda is used in mercerizing process. (T/F)

6. Bleaches are used in laundry to remove stains. (T/F)

7. Bleaching agents can be divided into 3 classes. (T/F)

8. Oxidizing bleach supplies nitrogen that combines' with stains to produce colorless compound. (T/F)

Short Answer Type Questions

1. What is calendaring?

2. What are finishes?

3. What is singeing?

4. What is tentering?

5. What is mercerizing?

7. What are finishes? Write about calendaring and singeing?

Long Answer Type Questions

1. What are the different types of calendaring finishes given to different types of textiles?
2. What finish appeal to touch? Explain.
2. Differentiate between napping and parchmentization?
4. How is burnt out finish different from parchmentisation?

Answers for Test your understanding

1. True
2. True
3. False
4. True
5. False-18-20% is used
6. True
7. False- 2 classes
8. False - Oxygen
9. True

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