CHAPTER

1

Finishing

3QKQNP

LEARNING OBJECTIVES

- **To gain knowledge about the types of finishes suitable for different types of fabrics**
- **To understand the modifications in fabric properties after imparting finishes**

1.1 Introduction

Every fabric needs to look appealing to the eyes and feel good when touched. This can be achieved through fabric finishing. It is a process of converting woven or knitted fabric into a more useable material. The main modification done by finishing is improving the look, performance or hand feel. It not only changes the fabric appearance but also provides aesthetic value, improves its softness, adds comfort and durability, provides safety and improves the performance of the fabric. Finishes can also be applied during yarn formation stage. Some of the uses of finishing are:

- To improve the appearance of the fabric like colour, pattern and shine
- To change the texture of the fabric by giving finishes like embossing and smoothening
- To improve the feel of the fabric by making it softer, crispier or firmer
- To improve the drape of the fabric by adding or removing weight to it
- To improve the wearing qualities of fabric like crease resistance, stain resistance, flammability and water proofing
- To modify the care requirements of the textile like easy wash, quicker drying time, colour fastness and less shrinkage

Different fabrics undergo different finishing techniques depending upon the nature of fabric, its physical and chemical properties and its intended use. Finishing operations differs according to the properties imparted to the textile material.

1.2 Classification of Finishes

Textile finishes can be classified in many ways. The two main groups of finishes are:

1.2.1 Functional Finish

This type of finish changes the internal performance of the fabric. These are given to improve the aesthetic purpose of a fabric. Thus functional finishes can be further divided into two groups :

1. Aesthetic Finish
   It is given to enhance the fabric appearance and its draping ability. Some of the important aesthetic finishes are :
   - Napping and scudding
   - Mercerization
   - Shearing
   - Softening
   - Stiffening

2. Performance Finish
   It is given to enrich the fabric properties like strength and durability. Some of the important functional finishes are :
   - Antimicrobial
   - Moth proof
   - Crease resistant
   - Durable press
   - Soil resistant
   - Water repellent or water proof
   - Shrink proofing
   - Flame resistant

1.2.2 Quality Finish

These types of finishes improve the quality of the fabric based on the time line or usage. They can be temporary, semi-permanent or permanent.

1. Temporary Finish
   As the name suggest the temporary finish is not a stable finish and it disappears immediately after the first wash or first few washes. It includes finishes like :
   - Starching or sizing
   - Softening
   - Embossing
   - Calendaring

2. Semi-Permanent Finish
   This finishing is durable than temporary finish and can withstand more than 10 to 15 washes. It includes finishes like:
   - Schreiner calendaring
   - Buckram finish

3. Permanent Finish
   Permanent finishing does not disappear and remains unaffected through all the conditions of wear and washing treatments given to the fabric. It includes finishes like:
   - Flame retardant
   - Resin finish
   - Sanforising
   - Water proof or water repellent

1.3 Types of Finishes

Scouring and bleaching are done prior to other finishes, as they improve the property of raw fabric for further processing hence they are also grouped under finishing. Some of the common finishes are discussed below.

1.3.1 Scouring

Scouring is the process by which all natural and additive impurities such

as oil, wax, fat and dust are removed to produce hydrophilic and clean textile material. It is one of the vital processes of wet processing.

Objectives of Scouring

- To make the fabric highly hydrophilic
- To remove impurities such as oils, waxes, gum, husks as nearly as possible
- To increase the absorbency of fabric or textile materials without physical and chemical damage
- To produce a clean material by adding alkali
- To prepare the fabric for subsequent process
- To remove non-cellulosic substance in case of cotton

Scouring can be carried out by two methods:

Saponification

The vegetable oil like glycerides of fatty acids, are present in the raw fabric. These oils are immiscible with water and hence they are heated with a solution of sodium hydroxide in water making the oil split up into its constituents-fatty acid and glycerine. Glycerine is mixable with water easily and the fatty acids react with sodium hydroxide present in the solution forming its sodium salt i.e. soap which is also soluble in water. Thus oil is removed from the fabric.

Emulsification

The wax and non saponifiable oils present in the fabrics are removed by emulsification. As the waxes and oils are not mixable in water a normal washing soap is used as an emulsifying agent. The soap makes an emulsion of the waxes and non saponifiable oils in water and brings them out.

The changes that occur during scouring are as follows :

- Saponifiable oils and free fatty acids are converted into soaps
- Pectins and pectoses are converted into soluble salts of pectic acid
- Proteins are degraded to simple soluble amino acids or ammonia
- Mineral matters are mostly dissolved
- Non- saponifiable oils are emulsified by the soluble soaps generated from the saponifiable oils
- Additive stains are removed
- Residual sizing materials are broken down into soluble products

The chemicals used in scouring are:

1. Caustic soda - to neutralize acidic materials, to saponify glycerides (waxes and oils), to solubilise silicates.
2. Surfactants - to reduce surface tension and minimize interfacial tension.
3. Detergents - to emulsify oil, fats, waxes and remove oil -borne stains.
4. Chelating agent - to deactivate metal ions.
5. Sodium silicate - to penetrate and break down lignins
6. Soda ash - to maintain pH
7. Solvent - to assist emulsification by dissolving oily materials.

1.3.2 Bleaching

Bleach is a chemical that removes colour or whitens a fabric via oxidation or reduction method. Many types of bleach have strong bactericidal properties, and are used for disinfecting and sterilizing.

Bleaching is another important pre-treatment next to scouring, performed on cotton fibres. This treatment is given to decolourize the natural colouring matter present in the cotton fabrics and impart a pure white colour. It increases the ability of the textile materials for dyeing and printing by removing any traces of colour present in it. Normally oxidative bleaching action is performed in the industries on cotton fibre substrates. Though a number of bleaching agents are available in the chemical market, few bleaching agents are used extensively. Calcium hypochlorite (CaOCl), Sodium hypochlorite (NaOCl) and Hydrogen peroxide (H_2O_2) are the most frequently used bleaching agents in the conventional cotton processing units.

Hydrogen peroxide is considered a universal bleaching agent, as it is suitable for all sorts of textiles. It is stable at neutral and value is near neutral pH. The pH of hydrogen peroxide solution can be modified based on the suitability. Processing pH of cellulosic is between 9 and 11.5; proteins 2.5 to 6.0 and for synthetics it is near neutral acidic pH.

In order to bleach cotton, the pH of hydrogen peroxide solution is maintained at around 11. When alkali is added the stability of hydrogen peroxide is reduced and decomposed at a fast speed. To control the rapid decomposition a stabilizer is added to the solution. The ingredients added during peroxide bleaching are normally; hydrogen peroxide (bleaching agent, 1-3% owm), sodium hydroxide or carbonate (bleaching promoters, 0.25 to 1.0% owm), sodium silicate (buffer or stabilizers, 0.5 to 1.0% owm)

$$H_2O_2 \longleftrightarrow H^+ + HO_2^-[\text{Stable}]$$

$$HO_2^- \longleftrightarrow [OH]^- + (O)[\text{Unstable}]$$

In the alkaline condition the instability of peroxide is continued by the concentration. The liberation of nascent oxygen is utilized for the oxidation reaction in a controlled manner by selecting the stabilizers to get uniform application.

Figure 1.1 Scouring Bleaching machine

1.3.3 Calendaring

It is a mechanical process that finishes the fabric, by passing it between sets of rollers and applying heat and pressure. The outside of the rollers can be smoother or engraved to give the perfect finish to the fabric, the structure of the rollers varies from hardened chromium plated steel to elastic thermoplastic rollers. By varying the rollers, adding any additional chemical treatment and temperature, a variety of calendared finishes can be produced like glazed or moiré fabrics.

Objectives

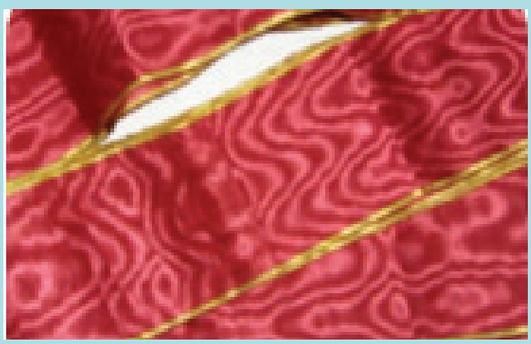
Calendaring is done for many purposes but the main objectives are:

- To give softening to the face side of the fabric
- To increase fabric lustre or glaze
- To give silk like appearance

- To close the open threads
- To decrease the air permeability
- To increase the fabric clarity
- To flatten the slubs
- To modify the fabric surface by embossing

DO YOU KNOW? What do you mean by Moiré?

Moiré, is a textile material with a wavy (watered) appearance. It is produced mostly from silk, and sometimes from wool, cotton and rayon. The characteristic watery appearance is achieved by calendaring.



In general a calendaring machine has 2 to 7 rollers with most common being the 3 bowl rollers. Less number of bowls is used for lightweight fabrics whereas more numbers of bowls are used for calendaring heavy weight fabrics. The bowls are made with alternating hard steel and elastic. The elastic bowl is usually made from compressed paper or compressed cotton, however a lot of modern calendaring machines are made with Nylon 6 covering. This provision is given so that there remain resiliency between the two consecutive rollers and the compression remains uniform. Heating arrangements are made via steam circulation chamber.

Figure 1.2 Three Roll Calendaring Machine

The process parameters that can be controlled during calendaring are speed of the fabric, speed of the rollers and the surface of rollers. Different types of calendared effects are: surface glazing, ciré effect, moiré effect, Schreiner effect and embossing effect.

Different treatments are given to the fabric before calendaring. For example, to obtain a glazed finish like chintz (polished cotton), the fabric is first saturated in starch or wax or resin solution and is dried before calendaring. Starch or wax gives a temporary finish to the fabric but if the fabric is saturated in resin, it gives a durable glaze.

Calendared fabrics with their glossy or wet look are produced in the same manner as glazing. The fabrics are coated with a wax or resin before being calendared with heated rollers. When thermoplastic fibres are used, the fibre surface that comes in contact with the metal rollers melts and flattens slightly and produces a highly polished fabric. Examples of calendared fabric are taffeta, satin or tricot, silk or silk blend fabrics.

Moiré fabrics have characteristic water marked look that is produced during the calendaring process. The effect is developed using either a moiré embossing roller or by a high compression calendaring of two layers of ribbed-base fabric in a single pass. One popular method of preparing moiré fabric features using rollers that have been engraved with a design. The fabric is run between the engraved rollers with some sections of the fabric squeezed to reveal the finished design that has a watery look. This type of application is often used to create material styles that are ideal for evening gowns, clutch handbags, and other types of formal apparel and accessories for women.

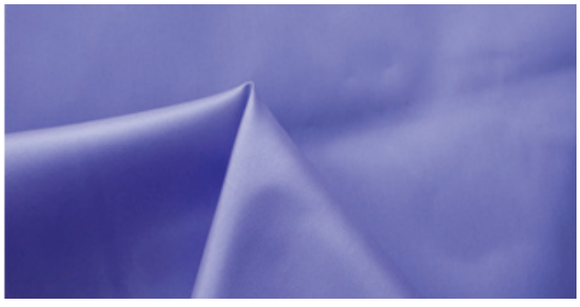


Figure 1.3 Calendared Cotton Fabric

Schreiner finishes on fabrics produce soft lustre and hand by flattening the yarns and surface of a fabric through calendaring. The Schreiner calendar has a metal roller engraved with 200-300 fine diagonal lines per inch that are visible only under a magnifying glass. A Schreiner finish is used on cotton sateen and table damask to make them more lustrous and on nylon tricot to increase its cover.

Fabric embossing can also be carried out in the calendaring machine in which the fabrics can have a pattern imprinted or embossed into it. The embossed pattern is created by passing the fabric between a heated embossing roller and a shaped paper roll. The degree of lustre given to the fabric can be modified by heating the chilled iron roll, by changing the pressure at the nip, by changing the speed of the machine, by carrying the moisture percent present in fabric. Various designs can be created by using a 2-bowl embossed roller or 3-bowl embossed roller arrangement.

1.3.4 Embossing

Embossing is a process that alters the surface of the fabric by providing a three dimensional or raised effect on selected areas. The embossing procedure requires the use of two dyes: one that is raised and one that is recessed. When the dyes are produced, a dyes maker engraves the desired design into several metal plates, which are the embossing dyes for use on an embossing machine. The engraved and the recessed dyes fit into each other so that when the fabric is pressed between them, the raised dye forces the fabric into the recessed dye and creates the embossed impression. A specific level of pressure is applied to the dye in order to squeeze the fibres, which results in a raised area. The embossed design is permanent if the fabric has a thermoplastic fibre content or if a resin is used or the fabric is heat set. Embossing is often used in combination with foil stamping.

Figure 1.4 Fabric Embossing Machine

1.3.5 Sizing or Starching

Size is one of the numerous substances that is applied to a yarn or fabric to act as a protective filler or glaze. In sizing or starching, the fabric is immersed in a mixture containing waxes, oils, glycerines and softeners to control the fabric body by adding stiffness and weight. If the sizing is resin based and heat set, it is permanent in nature but if the size is water soluble, it is removed during washing. Gelatin is used on rayon's because it is a clear substance that enhances the natural lustre of fibres.

Figure 1.5 Sizing Machine

In the weaving process the fabric warp has to undergo several types of actions like cyclic strain, flexing, abrasion at various loom parts and inter yarn friction. To reduce the breakage of yarns in the weaving process the warp yarns are sized before weaving which increases its strength, abrasion resistance and decreases the yarn hairiness. Different types of water soluble Polymers Vinyl Alcohol (PVA) called textile sizing agents or chemicals such as modified starch, Polyvinyl Carboxy Methyl Cellulose (CMC) and acrylates are used as sizing agents. In order to reduce the abrasiveness of the warp yarns wax is also added to the sizing liquor. The type of yarn material, the thickness of the yarn, type of weaving machinery determines the sizing recipe. The sizing can be done by hand or sizing machine. After the weaving process gets over the fabric is desized to remove the sizing liquor.

1.3.6 Stiffening

Stiffening agents are applied to the cloth to increase the weight of the fabric, to improve its thickness and lustre. Depending on the end use of the fabric, some fabrics are needed to be made stiffer and crispier. But, the effect of these stiffening agents is temporary and once the fabric is washed, most of the finishes are removed. Stiffening agents such as starches which are used for finishing of cotton cloth are derived from potato, wheat or corn. Dextrin's are used for dyed and printed fabrics as they do not have any undue effect on the dye or print of the cloth. Natural gums are mainly used in printing as well as finishing process whereas modified cellulose like resins are used as stiffening agents.

Figure 1.6 Double Stiffened Buckram Fabric

Acid stiffening is mostly used for fine yarn cotton fabrics as it gives stiffness as well as transparency to the fabric. It involves rapid immersion in sulphuric acid, followed by immediate neutralization

by sodium hydroxide. The finish is permanent in nature and is also known as Organdi finish or Parchmentisation.

1.3.7 Softening

Softening of fabric is a very important functional finish which is required to give a pleasant hand feel to the fabric and impart better drapability. Fabrics that are harsher and stiffer because of their construction or due to some prior finishing process are softened by this method. Softening can be done by either mechanical or chemical process. Simple calendaring softens hand of the fabric, but is temporary in nature. Silicone compounds are mostly used as softeners which are durable and require curing. The different types of softeners are anionic softeners, cationic softeners, non-ionic softeners, reactive softeners, emulsion softener and silicon softeners. Other types include emulsified oils and waxes which often result in a semi-durable finish.

Figure 1.7 Fabric with Bad Drape at Left and Fabric with Good Drape at Right

Anionic softeners are not fast to wash. They are compatible with resin and used as a temporary finish with starch and cationic product.

Example: Sulphonated oils and fatty alcohol sulphates. Non-ionic softeners have excellent stability against yellowing and are not fast to dyeing. Cationic softeners are substantive to cellulosic material and therefore, remain on cloth for few washes. They are compatible with resins. Reactive softeners are more durable softeners and react chemically with the (–OH) groups of cellulose. They are more expensive and also toxic in nature. Emulsion softeners are more popular because it reduces the loss of tear strength on resin finish and are fast to washing. Silicon softeners are the most used softeners in recent times. These are the manmade polymers based on the framework of alternate silicon and oxygen bonds with organic substituent are attached to silicone.

1.3.8 Shearing

Shearing is a process that evens out the length of the pile of a fabric in a controlled manner. It removes the surface fibres, yarn ends, knots and similar irregularities and surface flaws with the help of cropping or cutting. The fabric is passed through a series of tension bars and over an angled shearing bed which uses blades to cut the protruding fibres. The shearer head consists of spiral blade which is in contact with a ledger blade. The fabric is wound helically around a rotating cylinder which moves around spiral blade and ledger blade. Strong suction is used to remove the cut fibres from the machine.

The distance to move the bed of ledger blade is adjustable and the height of the pile can be regulated. Shearing may also create a smooth surface or a patterned or sculptured effect by flattening portions of the pile with an engraved roller and shearing off the areas that remain erect, and steaming the fabric to raise the flattened or taller portions. Thus Shearing can be used to create raised patterns or to smooth the overall nap of a fabric.

Some sheared fabrics are also brushed. Fabrics are brushed to remove loose fibres, and in some cases, to direct the nap of the surface in a single direction. Common examples of fabrics with brushed finishes are brushed corduroy, brushed denim and brushed flannel.

Figure 1.8 Industrial Fabric Shearing Machine

When was first Antimicrobial finish given on fabrics?

Evidences of fabric dipped in turmeric for the purpose of wound healing are identified during excavation of Indus Valley Civilization. This is the first evidence on antimicrobial finish.

Compounds like 8-hydroxygiunoline salts, copper naphthenate, copper ammonium fluoride and chlorinated phenols were used on cotton as fungicides in the World War II by the US army Quarter.

Antimicrobial finish

1.3.9 Singeing

Singeing is the removal of surface fibres by an intensive flame or by reflected heat. Singeing refers to burning off. It is an important pre-treatment process of the fabric and if not done properly results in unclear prints and patterns. It is often used with shearing to control surface fibres and particularly fibre blends. Singeing is more intensive than shearing as it penetrates deeper into the fabric than is possible by shearing, which is limited to the fabric surface.

Objectives

- To get a clear and smooth surface
- To obtain a soil less fabric
- To print patterns with higher clarity

At first the fabrics are brushed lightly to remove the undesirable fibres and then the fabric is passed over heated copper plates. The flames burns the fibre ends and the singeing area then enters a water bath. The water bath stops any singeing sparks and later the cloth is removed.

Figure 1.9 Gas Singeing Machine

1.3.10 Napping

It is a mechanical finish in which fibres are raised from the woven or knitted fabrics by rotating, bristled and wire covered brushes. The fabric brings out

raised fibres all through its surface. The examples of napped fabrics are cotton flannel, rayon flannel, woollen and worsted napped fabric like kersey and melton. Napped fabrics have softer handle, better insulation properties due to more air entrapment. These fabrics are mainly used as blankets and for winter clothing.

Figure 1.10 Napping Machine

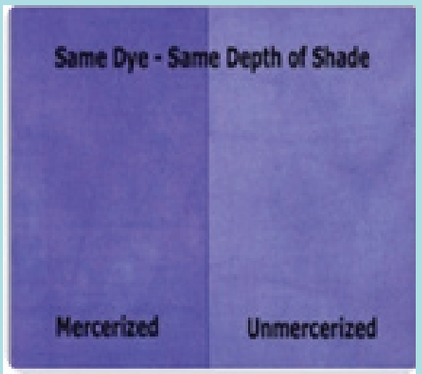
1.3.11 Mercerization

It is a finishing treatment of cotton and/or natural fibres composed by cellulose with a strong caustic alkaline solution (300 g/l) in order to improve its appearance by making it lustrous. The finish was named after its discoverer, John Mercer (1791-1866). He invented a process in which cotton can be given a lustrous finish resembling silk which was named "mercerization". The strong caustic soda on cellulosic material causes the fibres to swell and simultaneously there is a longitudinal shrinkage in the fibre. The morphological structure of the fibre gets modified giving it a shinier surface which is also resistant to wear and washing. Thus, we can say that mercerising results in the swelling of the cell wall of the cotton fibre which increases its surface area and reflectance and giving the fibre a softer feel.

DO YOU KNOW?

Why is mercerization been done on textile fabrics?

It is done to impart a greater affinity for dyes and chemical finishes, to increase tensile strength and lustre



Types of Mercerization

There are two types of mercerization:

Tension Mercerization

- The purpose of tension mercerization is to increase lustre of Cotton fibres
- The fibre untwists and swells, lumen becomes rounder in cross-section and it gains lustre
- Dye affinity and chemical reactivity increase
- Fabric becomes stronger and smoother

Slack Mercerization

- Slack mercerization is not as lustrous as tension mercerization
- Improves elongation and recovery properties
- Used for producing comfort stretch garments and fabric bandages, which need to conform to body shapes.

Mercerisation alters the chemical structure of the cotton fibre. The structure of the fibre inter-converts from alpha-cellulose to a thermodynamically more favourable beta-cellulose polymorph.

Figure 1.11 Mercerizing Machine

Process

The mercerizing process involves these three steps:

Step 1: Impregnation of the material in relaxed state with cold caustic solution of required strength and wet-ability.

Step 2: Stretching while the material is still impregnated in the caustic solution.

Step 3: Washing off the caustic soda from the material while keeping the material still in the stretched state.

An optional last step in the process is passing the thread over an open flame; this incinerates stray fibres, improving the fabric's appearance. This is known as "gassing the thread" due to the gas burner that is typically used.

Mercerizing can take place directly on grey cloth, or can also be done after bleaching. It can be done with or without tension in both cold and hot conditions. In both cases the mercerised cotton has an increased affinity for both reactive and direct cotton dyes, water and an increased strength.

Advantages of Mercerization

- Larger dyeing affinity
- Larger dimensional stability of the articles
- Increasing of the lustre
- Increasing of the tensile strength
- Better covering of dead cotton
- Improving touch

1.3.12 Heat Setting

Heat setting is an important part in textile finishing. It is one of the functional finishes which are carried out mainly on synthetic fabrics. It eliminates the internal tensions generated during the manufacture of fibre and fixes the new state by rapidly cooling it. Heat setting fixes the fabrics in the relaxed state and thus avoids subsequent shrinkage or creasing of fabric. Presetting of goods make it possible to use higher temperature for setting without considering the sublimation properties of dyes and also has a favourable effect on dyeing behaviour and running properties of goods. On the other hand, post-setting can be combined with some other operations such as thermasol dyeing or optical brightening of polyester. Post-setting as a final finish is useful to achieve high dimensional stability, along with desired handle.

Figure 1.12 Heat Setting Machine

1.3.13 Water Proof Finish

Water proof finish gives the resistance of water to the fabric. To increase the resistance various substance like paraffin, acid, resin, tannin, drying oils, alum or alumina salt carbonate magnesia are applied on to the fabric. The number of times the coating is done varies depending upon the substance used. A water-proof fabric is completely moisture proofed. The fabric is coated or laminated with a film of natural or synthetic rubber or plastic, such as vinyl or polyurethane to give proofing effect. Water proof finishes adversely affect the comfort property of the fabric as they limit the passage of air and possesses a rather firm and a bad hand feel.

Figure 1.13 Water Proof Fabric

1.3.14 Water-Repellent Finish

Water repellent finishes are chemical finishes which resist the penetration of water into the fabric but permits the passage of moisture or air. When the fabric becomes very wet the water eventually passes through it. The yarns are coated with the repellent material like wax which permits the passage of air and vapour between the interlacing in the fabric. Water and the other liquid remain on the surface in small bead rather than spreading out and getting absorbed. The chemicals used are silicones, fluorocarbons, paraffin's etc. Some chemicals used for water repellency are also stain repellent. The combination of fabric finish and structure is important to achieve water repellent finish because it depends on the surface tension and fabric penetrability. The combination can make fabric which is stain resistance, having soft feel and a good drape.

Water repellent finish can be of both durable and non-durable types. The non-durable repellents are easily removed in laundering or dry cleaning. They do not provide satisfactory resistance to oily liquids. Durable repellent finish can be either repellent to water or oil or both. Fluro-carbon compounds have excellent durability to both dry cleaning and laundering.

DO YOU KNOW?

Do you know the oldest finished fabric?

Fulling cloth is one of the oldest finished fabrics. It is seen in Scots hat woven fabric, done centuries ago using engraving to change.

1.3.15 Flame Retardant Finish

Flame retardant finishes is one of the varieties of functional finishes. They play an important role on textiles by providing safety and giving escape time from a potential hazard. When a fire starts flame,

retardants reduce the flame spread and rate of fire development by blocking the flames access to fuel and hindering future flame propagation. Boric acid/Borax, Di-ammonium Phosphate and Phosphoric acid, Sulfamic acid and Ammonium Sulfamate are a few substances used for non-durable flame retardant finishes. The durable flame retardant finishes include chemicals such as THPC- Tetakis Hydroxymethyl Phosphonium Chloride and its derivatives, N-Methyldimethyl Phosphonopropioamide, Phosphonic and Phosphoric Acid and its derivatives.

Figure 1.14 Flame Retardant Jacket

1.3.16 Anti-Microbial Finish

Antimicrobial finishes restrain the disease and decrease the risk of infection from following injury likes development of bacteria, other aroma causing germs, damage from perspiration and decay. These finishes are also called anti- bacteriostatic, germicidal or antiseptic finishes These finishes are mainly used for clothing that comes in close contact with the skin like shoe linings, hospital linings and carpeting. Wall covering and upholstery are also treated with antimicrobial chemicals. It is added to the spinning solutions in manufacturing fibres.

The most common chemical used for imparting anti-microbial finish is ziconium peroxide and sometimes an exposure to ethylene oxide gas is also used. Sutures, bandages and surgical gloves are treated with ethylene oxide because it is easy to available, low cost, safer and ultimate for medical products. The sterile environment to be maintained until the package is opened. Antimicrobial finish process includes gas treatment, chemical treatment and irradiation treatment.

Figure 1.15 Uses of Anti-Microbial Finished Fabrics

1.3.17 Antistatic Finish

Synthetic fibres of hydrophobic nature are prone to generation of static charges. This problem is very troublesome while processing the fabric at high speed in dry state. Static electricity is produced or created when two non-conducting surfaces such as synthetic textiles rub together. The two surfaces become oppositely charged and as the rubbing continues an electrical charge builds up. The wearer can experience the electric shocks and the fabric tends to cling to the body of the wearer. Antistatic finishes are chemical substances applied to reduce and eliminate static charge. The chemical substance used absorbs moisture from the atmosphere and thus reducing the

dryness of the fabric that causes the static charge build up. Anti-static effective chemicals are largely chemically inert and require thermosol or heat treatment for fixing. In general thermsolable anti-static agents also have a good soil release action which is as permanent as the anti-static effect. Anti-static finishes may also be of polyamide type being curable at moderate temperatures.

1.3.18 Moth Proof Finish

Moth proofing finish is a kind of functional finish given to textiles to prevent the growth of moths. Moths like silverfish attack fibres like cotton and wool. Fluorine compounds, napthalene, DDT and paradichloro benzene are some of the chemicals used for imparting moth proof finishes to fabrics. They are available in crystal, cake and spray form. Cellulosic fibres are also treated with boric acid to prevent the rapid growth of mildew and fungus.

Figure 1.16 A Woollen Fabric Eaten by Moths

1.3.19 Shrink Proofing or Sanforising or Compacting

Controlled residual shrinkage is an important quality parameter for many fabrics. For example, excessive shrinkage is undesirable for fabrics to be made into garments. Here, the residual shrinkage should be less than 2% otherwise the garment will not fit after it is laundered. Mechanical compacting is one method of reducing residual shrinkage. The process forces yarns closer together and the fabric becomes thicker and heavier. As a result of this, the net yardage yield is reduced. A sanforizer is a fabric compactor developed by Cluett Peabody. The term 'Sanforized", is their registered trademark and is used to market fabrics that meet certain shrinkage specifications. The term Sanforized is now generally accepted to mean a fabric that has low residual shrinkage. It is used to describe shrink proofing processes. The process, consists of a range where the fabric is first moistened with steam, to make it more pliable, run through a short tenter frame to straighten and smooth out wrinkles ,through the compressive shrinkage head and then through a Palmer drying unit to set the fabric.

The key to any compactor is the head where force is applied to move parallel yarns closer together. More fabric must be fed in than is taken off. A Sanforizer uses a thick rubber blanket running against a steam heated cylinder as the compacting force. The thick rubber blanket first goes over a smaller diameter roll which stretches the convex surface of the blanket. Fabric is metered onto the stretched blanket and the fabric and blanket together come in contact with the steam heated cylinder. At this point, the stretched rubber surface contracts to its original length and then is forced to contract an additional amount as it forms the concave configuration of the heated drum. Since the fabric is not elastic, an extra length of fabric is thrust between the rubber

blanket and the heated cylinder. Friction between the rubber blanket and steel drum force adjacent yarns to move closer together until the unit length of fabric become equal to the unit length of rubber blanket it rests on. Heat is created by constantly stretching and relaxing the rubber blanket. The blanket is cooled by spraying water on it after the fabric exits from the unit.

Figure 1.17 Compacting / Sanforizing Machine

The degree of shrinkage can be controlled by the thickness of the blanket. The thicker the blanket, the greater is the stretched length at the bend. A longer length of fabric will be fed into the compactor causing the degree of compacting to be greater. To be effective, the degree of compacting needed should be predetermined ahead of time. This is done by characterizing the shrinking behaviour of the fabric by laundering. The degree of compacting should not exceed the degree of shrinking otherwise over compacting will cause the fabric to "grow" when relaxed.

1.3.20 Soil Release Finish

Textile materials are attracted to dirt or soil. Development of static charge electricity to hydrophobic textiles makes them prone to soiling. This is not readily removed during laundering and gets re-deposited on the fabric. Also, the hydrophobic materials are not wetted properly during laundering which causes problem with staining.

Figure 1.18 Soiling of Fabrics

Soil release finish is one of the functional finishes which work by making the textile fibres more absorbent or hydrophilic. The hydrophilic finishes increase the wet ability of the fibre and facilitate soil release during washing. It also prevents soil re-deposition on the fabric. It also reduces the static charge on the cloth by maintaining moisture on the fabric surface which is mostly observed in polyester fabrics. They also improve the antistatic properties, fabric drapability and comfort.

1.3.21 Wrinkle Resistant or Crease Resistant Finish

The ability of the fabric to resist the formation of crease or wrinkle when slightly squeezed is known as 'crease resistance' of the fabric. The ability of a fabric to recover from a definite degree from creasing is called crease recovery. Finishes to reduce the undue wrinkles on fabric or garments is called as wrinkle resistance finish. Cotton, rayon and flax are more susceptible to wrinkles due to the hydrogen bonds of the cellulosic molecules in their amorphous region. Due to application of heat or moisture, the hydrogen bond breaks and new

hydrogen bond occurs at new dimensions. Therefore wrinkling can be reduced if the hydrogen bond formation is less. Resins such as Formaldehyde, DMU (Di-methylol urea), DMEU (Di-methylol ethylene urea), DMDHEU (Di-methylol di-hydroxyl ethyleneurea), and Modified DMDHEU (Di-methylol di-hydroxylethylene urea) are mainly used for imparting wrinkle resistance finish to a fabric.

Figure 1.19 Fabric with Crease Resistant Finish

POINTS TO REMEMBER

- Scouring and Bleaching are done prior to other finishes, as they improve the property of raw fabric for further processing.
- The wax and non saponifiable oils present in fabrics are removed by emulsification.
- Bleach is a chemical that removes colour or whitens a fabric via oxidation or reduction method.
- Bleaching treatment is given to decolourize the natural colouring matter present in the cotton fabrics and impart a pure white colour.
- Calendaring is a mechanical process that finishes the fabric by passing them between a series of rollers and applying heat and pressure.
- Calendared fabrics with their glossy or wet look are produced in the same manner as glazing.
- Embossing is a process that alters the surface of the fabric by providing a three dimensional or raised effect on selected areas.
- Stiffening agents are applied to the cloth to increase the weight of the fabric, to improve its thickness and its lustre.

ACTIVITIES FOR TEACHER

- To show different types of finishes
- To arrange a factory visit to finishing units

ACTIVITIES FOR STUDENTS

- Prepare an assignment regarding various types of finishes
- To ask the students to do a finishing process on the sample given to them.

INTERNET RESOURCES

https://www.youtube.com/watch?v=7ljwYeN7kbw	Knit Fabric Shrinkage/ Dyeing and Finishing Parameters
https://www.youtube.com/watch?v=X07XXMllnhc	Textiles: Industrial Finishing Processes

GLOSSARY

Embossing	Alters the surface of the fabric by providing a three dimensional or raised effect on selected areas
Shearing	A process that evens out the length of the pile of a fabric
Singeing	Removal of surface fibres by an intensive flame or by reflected heat
Mercerization	A finishing process to increase lustre of Cotton fibres
Heat setting	One of the functional finishes which is carried out mainly on synthetic fabrics.
Water proof finishes	A finish which gives the resistance of water to the fabric
Moth proof finishes	A finish to prevent the growth of moths

QUESTIONS AND ANSWERS

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PART – I
Objective Questions

1. To produce a smooth surface finish on fabrics_____ process is done
   (a) Starching
   (b) Singeing
   (c) Embossing
   (d) Heat Setting
2. The term_____ is used to describe shrink proofing processes.
   (a) Sanforizing
   (b) Singeing
   (c) Calendaring
   (d) Napping
3. The most common chemical used for imparting anti-microbial finish is_____.
   (a) Gelatin
   (b) Ziconium Peroxide
   (c) Thermasol
   (d) Polyurethane

4. In mercerization the fabric is treated with_____ solution.
   (a) Formaldehyde
   (b) Sulphur
   (c) Paraffin
   (d) Caustic Soda
5. _____ finish burns any fibre end projecting from the surface of the fabrics.
   (a) Flame Retardant
   (b) Anti Static
   (c) Singing
   (d) Mercerizing
6. Saponification is a process involved in _____
   (a) Bleaching
   (b) Scouring
   (c) Compacting
   (d) Calendaring
7. John Mercer discovered _____
   (a) Sanforizing
   (b) Bleaching
   (c) Emulsification
   (d) Mercerization
8. _____ fabrics have characteristic water marked look that is produced during the calendaring process.
   (a) Moiré
   (b) Ciré
   (c) Schreiner
   (d) Embossed
9. _____process is used for adding stiffness and weight to the fabric.
   (a) Singeing
   (b) Scouring
   (c) Sizing
   (d) Sanforizing
10. Shearing is a process that evens out the length of the pile of a fabric by _____
   (a) Burning
   (b) Cutting
   (c) Rubbing
   (d) Brushing

PART – II
Answer in Three (Or) Four Points

1. What is the need for finishing fabrics?
2. Give the types of quality finishes.
3. Define calendaring.
4. Briefly explain sanforizing.
5. What is shearing?
6. What are the objectives of singeing?
7. Briefly describe mercerization?
8. Why is softening finish given to a fabric?
9. What is scouring?
10. What are the uses of anti static finishes?

PART – III
Answer in a Paragraph

1. Explain the different types of effects achieved during calendaring.
2. What is starching and why is it used?
3. Give the advantages of mercerization.
4. Explain bleaching by hydrogen peroxide.
5. Name the chemicals used in bleaching?
6. Give the difference between water proof and water retardant finish.

7. Explain moiré fabrics.
8. Name some chemicals used in giving flame retardant finish.
9. Describe compacting.
10. What are the types of scouring?

PART – IV
Answer in One Page

1. What are water proofing finishes? Briefly explain types of water proofing finishes.
2. Explain Flame retardant finishes.
3. Elucidate the process of mercerization?
4. Explain the changes that occur in the fabric after scouring.
5. Explain the different types of calendared fabrics.

Answers for Objective Questions

1. (b)	2. (a)	3. (b)	4. (d)	5. (c)
6. (b)	7. (d)	8. (a)	9. (c)	10. (b)