Desizing

Desizing is done in order to remove the size from the warp yarns of the woven fabrics. Warp yarns are coated with sizing agents prior to weaving in order to reduce their frictional properties, decrease yarn breakages on the loom and improve weaving productivity by increasing weft insertion speeds. The sizing material present on the warp yarns can act as a resist towards dyes and chemicals in textile wet processing. It must, therefore, be removed before any subsequent wet processing of the fabric.

Objects of Desizing:

1. To remove the starch material from the fabric.
2. To increase the absorbency power of the fabric.
3. To increase the affinity of the fabric to the dry chemicals.
4. To make the fabric suitable for the next process.
5. To increase the luster of the fabric increase of dyeing and printing.

Factors of Size Removal Efficiency:

The factors, on which the efficiency of size removal depends, are as follows:

1. Type and amount of size applied
2. Viscosity of the size in solution
3. Ease of dissolution of the size film on the yarn
4. Nature and the amount of the plasticizers
5. Fabric construction
6. Method of desizing, and
7. Method of washing-off

Methods of Desizing:

package dyeing machine.

Sizing agents

Sizing agents are selected on the basis of type of fabric, environmental friendliness, ease of removal, cost considerations, effluent treatment, etc.

Natural sizing agents

Natural sizing agents are based on natural substances and their derivatives:

- Starch and starch derivatives; native starch, degradation starch and chemically modified starch products
- Cellulosic derivatives; carboxymethylcellulose (CMC), methylcellulose and oxyethylcellulose
- Protein-based starches; glue, gelatin, albumen

Synthetic sizing agents

- Polyacrylates,
- Modified polyesters,
- Polyvinyl alcohols (PVA),
- Styrene/maleic acid copolymers.

Desizing processes

Desizing, irrespective of what the desizing agent is, involves impregnation of the fabric with the desizing agent, allowing the desizing agent to degrade or solubilise the size material, and finally to wash out the degradation products. The major desizing processes are:

- Enzymatic desizing of starches on cotton fabrics
- Oxidative desizing
- Acid desizing
- Removal of water-soluble sizes

Enzymatic desizing

Enzymatic desizing is the classical desizing process of degrading starch size on cotton fabrics using enzymes. Enzymes are complex organic, soluble bio-catalysts, formed by living organisms, that catalyze chemical reaction in biological processes. Enzymes are quite specific in their action on a particular substance. A small quantity of enzyme is able to decompose a large quantity of the substance it acts upon. Enzymes are usually named by the kind of substance degraded in the reaction it catalyzes.

Amylases are the enzymes that hydrolyses and reduce the molecular weight of amylose and amylopectin molecules in starch, rendering it water-soluble enough to be washed off the fabric.

Effective enzymatic desizing require strict control of pH, temperature, water hardness, electrolyte addition and choice of surfactant.

Oxidative desizing

In oxidative desizing, the risk of damage to the cellulose fiber is very high, and its use for desizing is increasingly rare. Oxidative desizing uses potassium or sodium persulfate or sodium bromite as an oxidizing agent.

Acid desizing

Cold solutions of dilute sulphuric or hydrochloric acids are used to hydrolyze the starch, however, this has the disadvantage of also affecting the cellulose fiber in cotton fabrics.

Removal of water-soluble sizes

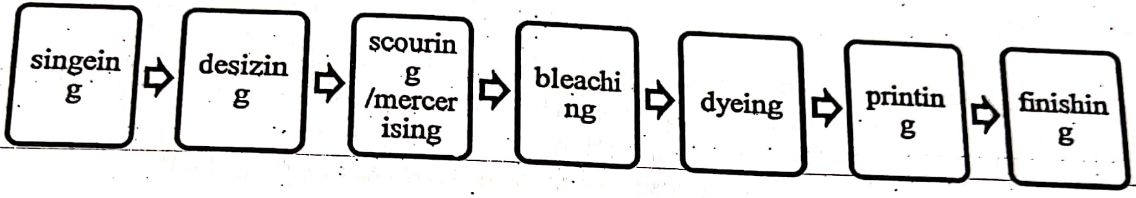
Fabrics containing water-soluble sizes can be desized by washing using hot water, perhaps containing wetting agents (surfactants) and a mild alkali. The water replaces the size on the outer surface of the fiber, and absorbs within the fiber to remove any fabric residue.

TEXTILE PROCESSING

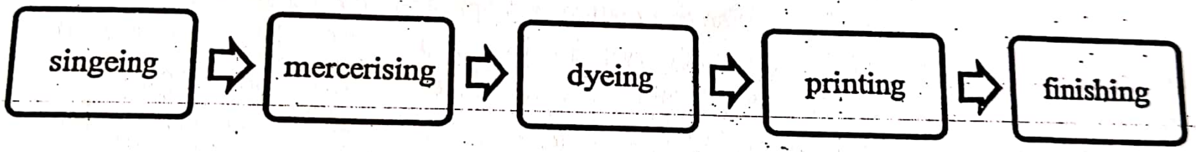
Textile processing can be defined as the process in which the textiles are subjected to various chemical or mechanical treatments in order to provide certain qualities to enhance the fabric and to remove certain redundant materials over the fabric surface.

TYPICAL SEQUENCE OF PROCESSES

SEQUENCE OF WET PROCESSING FOR WOVEN INDUSTRY



SEQUENCE OF WET PROCESSING FOR HOSIERY/ KNITTED INDUSTRY



OBJECTS AND METHODS

The main objectives of the wet processing are to

i. Remove the loose hairy fibers protruding from the cloth, & to impart a smooth even and clean looking a surface.

ii. Remove size from the Grey fabric which is applied during weaving and to make the fabric more absorbent for dyeing and printing process.

iii. Remove the unwanted starch from the fabric known as desizing.

Singing -Removal of loose hairy fibers protruding (or) projecting fibers from the surface of fabric by burning.

Desizing-Removal of size or starch materials present in the fabric.

Hot & Cold wash- Rinsing the impurities

Scouring - Removal of all impurities except natural coloring (Yellowish grey color)

Bleaching - Removal of natural coloring matter present in the material.

Mercerising
~~**Scouring**~~ - Neutralize the fabric, removes chlorine smell and also to improve the whiteness of fabric.

Dyeing -To apply color on the textile material

Printing to apply design on the fabric

Mercerizing-To increase the luster, Absorbency and strength of material

SINGEING

The Warp and Weft yarns are made up of large number of short fibers by a process of spinning and hence the tiny fibres protrude from the surface. If the cloth is woven from such yarns, it also has the protruding fibres on its surface.

These protruding fibres are removed by a process known as singeing and the machines as singeing machines.

IMPORTANCE OF SINGEING

If the cloth is not singed, it will have a matted raw appearance after finishing. The fabrics to be mercerized are singed to develop maximum luster in the fabric. In order to import a clearly defined and sharp design to the cloth in printing, the goods must be signed, otherwise dulling of the pattern and the hairy edges take places. Therefore singeing may be considered an important process from the point of view of mercerizing and printing.

TYPES OF YARNS TO BE SINGED

1. Combed cotton yarns
2. High twisted voile threads
3. Sewing threads
4. Polyester cotton blended yarns
5 Hosiery yarns meant for knitting

TYPES OF FABRICS TO BE SINGED

Shirting's, Suiting, Saree, Dress materials, voile cloths, poplins, and polyester cotton blended fabrics etc.

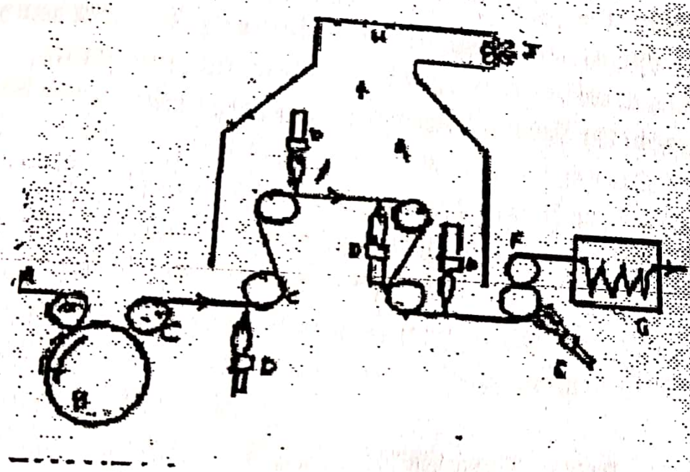
The object is achieved by three singeing machines namely.

1. Plate Singeing
2. Roller Singeing

GAS SINGEING MACHINE

This machine essentially consists of one or more burners given continuous flat or vertical flame produced by a mixture of compressed air and cool gas. The flame issues from a narrow slit, which is adjustable with respect to width and thickness of the fabrics. When the cloth is drawn over the flame at high speed, the flame impinges and its surface burns the protruding fibres without damaging the cloth. The speed of transmission of the cloth through the singeing machine has to be suit the amount of the singeing required without the risk of burning the cloth.

When the flame impinges on the cloth surface the fiber ends present in the interstices of the warp are also signed. Then the singed cloth passed between a pair of draw rollers or through the nip of a mangle revolving above the water through, so that all the sparks are extinguished. Alternatively a water spray of water on the surface of the cloth. In order to remove the burnt fibres and exhaust gases, a hood and fan are provided over the machine. It can be seen that by one passage of the cloth through the machine both the surfaces of the cloths are singed.



Parts:
A-Cloth
B-Hot Cylinder
C-Guide rollers
D-Gas burners
E-Water Sprayer
F-Squeezing roller
G-Steam chamber
H-Hood
J-Exhaust fan

ADVANTAGES:

1. Both sides are singed at a time.
2. Uniform singeing of the cloth is obtained.
3. No questions of unwanted lustier as there is no contact with any metal surface as in the case of other singeing machines such as roller and plate type.
4. Fibres in the interstices are burnt.
5. Speed is as high as 80 – 125 meters/min.
6. Flame can be controlled according to the width and thickness of cloth.
7. Different varieties of cloth can be signed.

DISADVANTAGES:

1. There is a chance of fire on the cloth: if the flame is not controlled property

HOD Sign

Faculty Sign

PRECAUTION IN GAS SINGEING MACHINE

1. The supply of gas and to the burner is automatically controlled if the mixtures of gas and air do not burn (or) if the fabric to move.

2. The machine is enclosed with hood and exhaust fan otherwise the dust, fluff will affect the eyes.

3. For observing, class windows to be fitted on the hood.

4. Before singeing the fabric is to be dried.

5. The temperature of singed cloth surface is to be measured continuously with help of thermo couple and pyrometer.

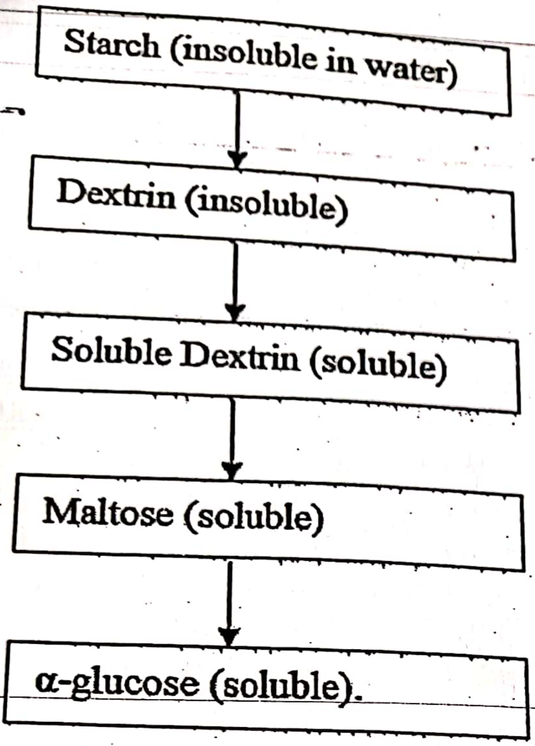
6. The speed of fabric is measured with speed counter and machine is provided with automatic fabric threading device.

7. The speed of the projecting fibres combustion is considerably lower than that of cellulose fabrics.

DESIZING

Grey cotton fabric contains naturals as well as those added to the fabric such as size to facilities weaving. Sizing components such as starch, CMC, PVA, vegetable oils, mutton tallow etc. are applied on to the warp yarns to strengthen it before weaving. These components make the fabric unsuitable for dyeing, Although the sizing of warp is a necessary operation to the weaver, this size in the Grey fabric is a source of trouble to the processors, since it hinders the penetration of the dye onto the fabric. Hence this unwanted size has to be removed for better dyeing and printing.

Chemically starch is poly-a-glucopyranose in which straight chain (amylase) and branched chain (amylopection) polymers are present. Both the constituents of starch are insoluble in water but they can be soubise by Hydrolysis of these long chain compounds to shorter ones. Thus under suitable conditions, starch can be progressively hydrolyzed to the following stages:



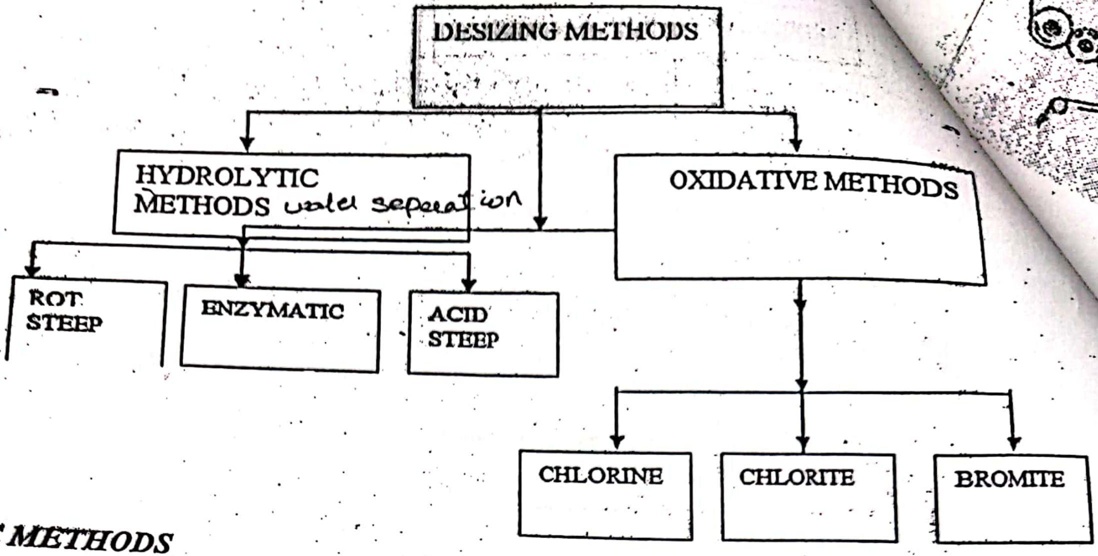
In desizing, the hydrolysis is carried out up to the stage of soluble dextrin.

Desizing is a chemical process and the rate of this can be controlled. For example, if the desizing liquor is stronger, the process will be completed in a short time and it can be made a continuous one. If weaker solutions are used, the process will take more time, and it would be a batch process.

Since the size mixture contains other ingredients for which the starch act as a binder, most of them are readily released and removed when the starch is hydrolyzed and washed off. For efficient sizing operation, 85 to 90% of the added size should be removed during desizing. Desizing should be done uniformly. Non-uniform desizing will give uneven scouring and bleaching and hence irregular.

CLASSIFICATION OF DESIZING METHODS

The methods available for desizing may be classified as follows:



HYDROLIC METHODS

There are three processes. They are

1. rot steep,
2. acid steep, and
3. Enzyme steep.

ROT STEEP:

This is the oldest and the cheapest method of desizing. Here no special chemical is used. The cloth is first passed through a padding mangle in which warm water at 40°C is kept and the cloth is squeezed to about 100% moisture contents (100% expression). The cloth is then allowed to stand for 24hrs. The microorganisms, naturally present in water, multiply and secrete starch liquefying (hydrolyzing action), enzymes, which solubilise the starch present in the size. The cloth is finally washed with water when most of the starch present on the fabric is removed.

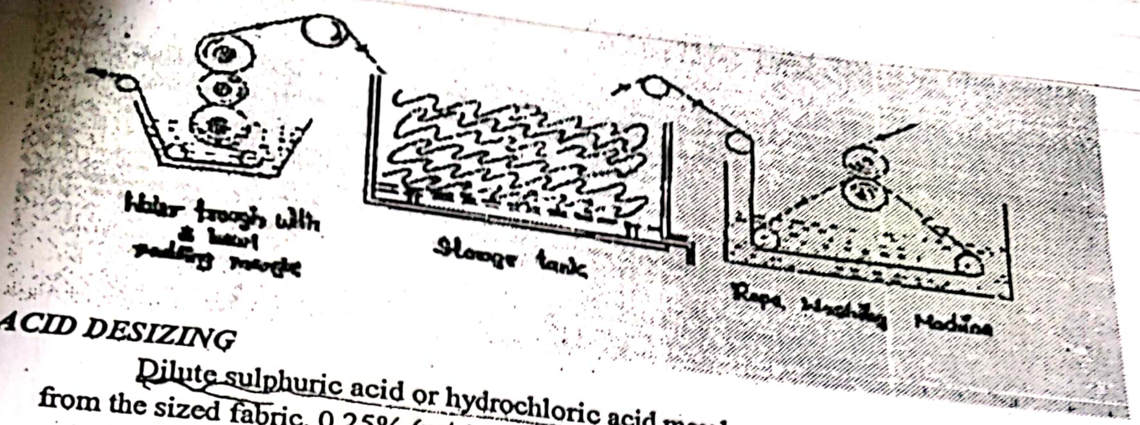
The formation taking place during rot steeping must not be too active, otherwise the cellulose itself may be attack.

ADVANTAGE:

1. Cheapest Method.
2. No chemicals are required

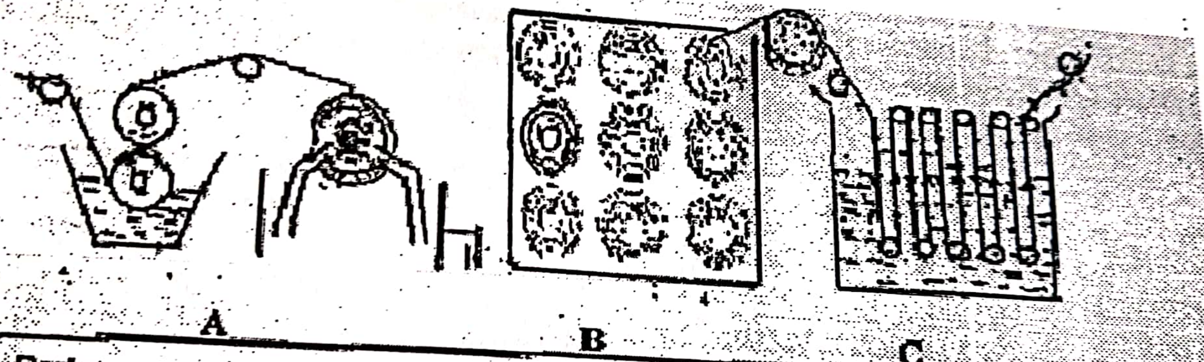
DISADVANTAGES:

1. Large floor space is required for this process.
2. Slow process and takes more time for desizing.
3. Mildew may attack and develop on the cloth during storage.



ACID DESIZING

Dilute sulphuric acid or hydrochloric acid may be used to hydrolyze the starch from the sized fabric. 0.25% (w/v) solution of the acid at room temperature (30°C) is sufficient for this process. The cloth is impregnated with dilute solution in a two bowl or three bowl padding mangle. Then the cloth is stored for 8-12 hrs. In a closed concrete pit, the starch is hydrolyzed by the action of acid during the storage period. Then the cloth is washed with water to remove the hydrolyzed starch.



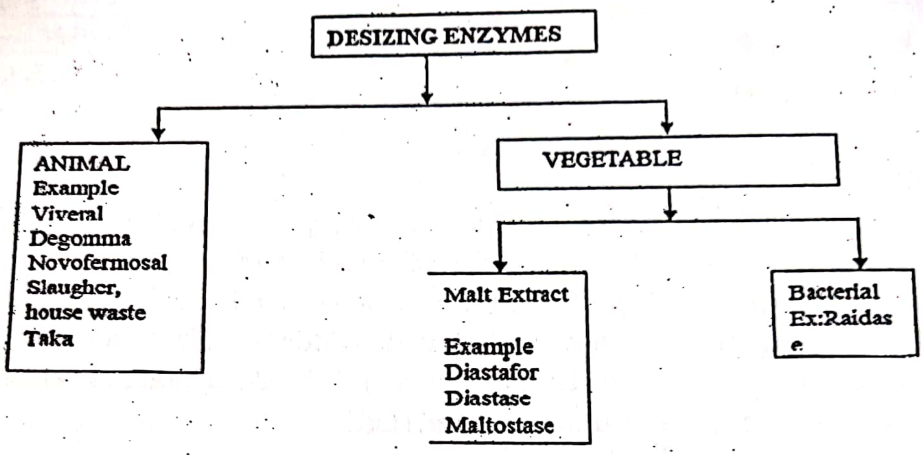
Parts:
A-0.5 to 1.0% of H_2SO_4 Or HCl B-Closed storage with slow rotation
C- Open width soaper

PRECAUTION:

The cloth should be stored in a closed concrete pit or wet gunny bags (jute cloth) are placed on the piled fabric. The reason is the following. The hydrolysis of starch is an exothermic reaction and as the reaction process, the temperature of the cloth rises sometimes to a temp 50°C. This temp., in normal conditions, does not hydrolyze the cellulose. But when the cloth is exposed to air during the storage period, local evaporation of water take place. This results in raising the concentration of the acid in the cloth if it is sufficiently high, cellulose is hydrolyzed. Therefore cloth will be weakened at the places where evaporation has taken place. Since this happens at random places, uneven degradation of cotton results. This is detected only after dyeing or printing when uneven dyeing takes place.

ENZYMATIC DESIZING

In enzymatic desizing, enzymes liquefy starch in the fabric. Desizing enzymes may be classified based on the source from which they are obtained.



Enzyme desizing is a very rapid and thorough method of desizing provided that the proper conditions of temperature and PH are maintained. The optimum temperature and PH of the different enzymes are

acid & alkalies

Enzyme	Temperature °C	PH
Malt Extract	50 – 60	6.0 – 7.5
Pancreatic	50 – 60	6.5 – 7.5
Bacterial	60 – 70	5.5 – 7.5

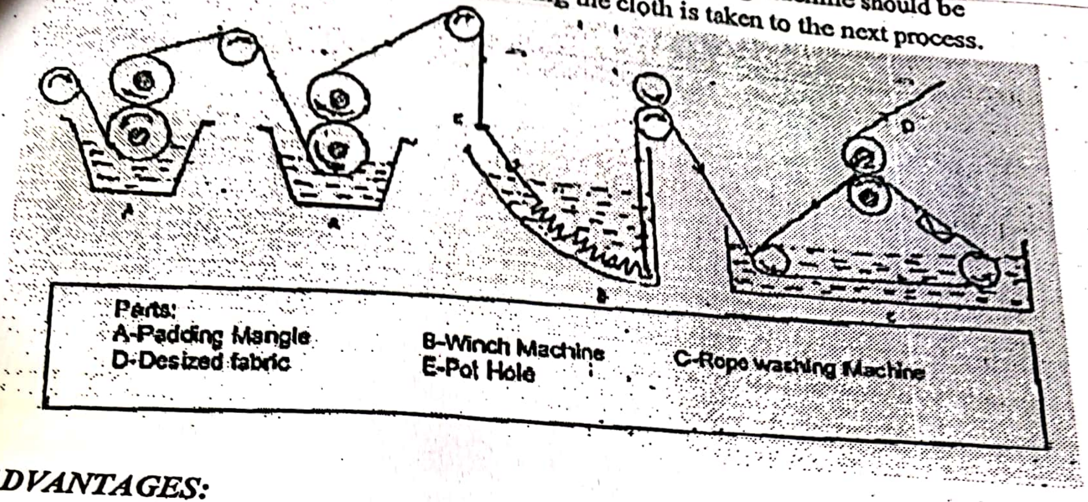
Enzymes suffer from one disadvantage that if the conditions of temperature and PH are not favorable, the desizing activity is destroyed.

CONTINUOUS DESIZING

The grey fabric is first passed through hot water and then through 0.5-2% malt extracts solution kept at 60°C to 70°C. The pre-impregnation of the cloth with hot water prevents the cooling of the malt extract solution. This extract is most active in the temp range 60°- 70 °C and PH 6-7.5

Normally when malt extract is used as the desizing agent, it takes about 3-4 hrs for complete desizing to occur. When stringer solutions are used the desizing action can be reduced to about 5 min.

The impregnated cloth with enzyme solution is taken over a winch and allowed to fall in a pit with a soling bottom, where the cloth assumes a wavy shape. After moving a sufficient length of the floor, the cloth is taken over guide roller and then to a washing machine. The length of the floor pit is such that the cloth takes about 5 min. for it travels from winch to washing machine. The impregnator and the washing machine should be synchronized with each other. After washing the cloth is taken to the next process.



ADVANTAGES:

1. Time of desizing process is less.
2. It is continuous process.
3. Closely constructed fabric can be easily desized.
4. There is no chance for the cellulose getting hydrolyzed

DISADVANTAGES:

If the conditions of temp and PH are not favorable, the desizing activity of the enzymes is destroyed.

OXIDATIVE DESIZING

There are three methods of oxidative desizing process they are
1. Chlorine desizing 2. Chlorite desizing and 3. Bromide desizing
In oxidative the starch is oxidized by oxidizing agents. This process is also known as grey chemicking.

SCOURING

After desizing the cloth contains oils, fats, wax and coloring matters. These oils and fats are higher fatty acids of inorganic of compounds. These oils, fats and wax are hydrophobic or water healing material; these compounds affect the absorbency of the cloth. This leads to improper dyeing, printing and finishing in the subsequent processes. These materials present in cellulose affect the penetration of the dyes onto the fabrics. Therefore they have to be removed from the fabric by another process called as scouring process. It is also called as kiering, kier boiling and boiling out etc. Boiling out is carried out in a boiler in which yarn or cloth is boiled with alkaline liquors. This boiler is called as 'Kier' and hence the terms kiering and kier boiling.

1. To remove natural as well as added impurities of essentially hydrophobic character (oils, fats, wax etc.) as completely as possible and leave the fabric in a highly absorptive conditions without undergoing chemical or physical damage significantly
2. To make the goods suitable for removing the natural coloring matter of the cotton during subsequent bleaching process.

The scouring process consists in circulating hot alkaline liquor (NaOH) usually under pressure (10-30 PSI or 1.5 to 2 kg per sq.m) through a regularly packed desized fabric for up to 12 hours with temperature of 100 - 130 °C The temperature of the Kier liquor, the pressure in the Kier, the composition of the Kier liquor, the duration of the boiling etc., depend on the nature of the goods being scored. Goods containing colored yarn, knitted goods of finer quality are scoured under milder condition at lower temp. The coarser and the medium quality goods are scoured under more pressure and high temp. Efficiency of boiling is essential for good bleaching.

DURING SCOURING THE FOLLOWING MAIN PROCESS ARE SCOURING:

1. Saponifiable oils are converted into soaps.
2. Unsaponifiable oils and waxes are emulsified.
3. Proteins are hydrolyzed into soluble products
4. Pectose and pectin are changed into soluble salts of Pac tic or Metapactic acid
5. Simpler amino compounds are dissolved or hydrolyzed to ammonia.
6. Mineral matter is dissolved.
7. Dirt particles are removed and help in a stable form in the kier liquor.

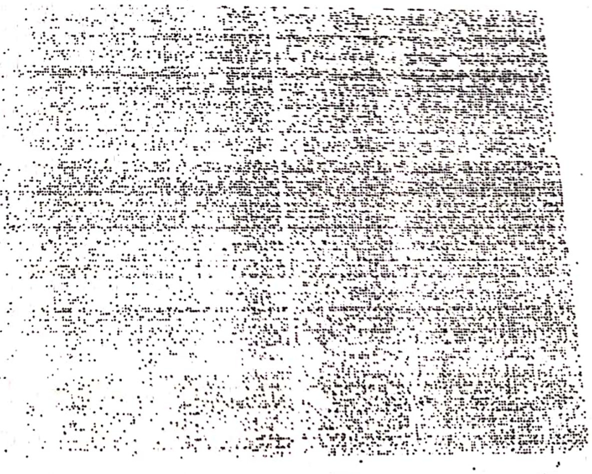
HEAT SETTING

Heat-setting is a term used in the textile industry to describe a thermal process taking place mostly in either a steam atmosphere or a dry heat environment. The effect of the process gives fibers, yarns or fabric dimensional stability and, very often, other desirable attributes like higher volume, wrinkle resistance or temperature resistance. Very often, heat setting is also used to improve attributes for subsequent processes. Yarns tend to have increased torquing just after spinning, cabling or twisting. Heat setting can influence or even eliminate this tendency to undesirable torquing. At the winding, twisting, weaving, tufting and knitting processes, an increased tendency to torquing can cause difficulties in processing the yarn. When using heat setting for carpet yarns, desirable results include not only the diminishing of torquing but also the stabilization or fixing of the fiber thread. Both twist stabilization and stabilization of frieze effect are results of the heat setting process. Heat setting benefits staple yarns as well as bulked continuous filament (BCF) yarns.

Heat setting often causes synthetic fibers to gain volume as well. This volume growth is commonly described as "bulk development". All processes using temperature and/or moisture to give textiles one of the above mentioned attributes are known as heat setting. The term "thermal fixation" is used less frequently. In the carpet industry, the process is exclusively called "heat setting" crinkle tendency is due to the technological conditions of the spun yarn production and the physical fiber properties. Above all, the "technological conditions of the spun yarn production" means the turning moment of the thread. A twisted thread will always try to twist when it hangs freely between two fixed points in the form of a loop. In doing this, it gives up a part of its original twist which becomes spirals whose twisting direction is opposite to the original twist direction. This development of twist in the opposite direction occurs as the twisted yarn attempts to reach equilibrium.

Twisting in the opposite direction is due to the tensions resulting from the yarn twisting that Mueller indicated in the diagram of tension and pressure. The total tension acting against the twisting is increased in relation to increased twisting due to the increasing tension and pressure of the bundle of fibres in the yarn. It may become so strong that the thread core buckles when it can no longer withstand the compressive strains. The yarn curls, meaning that the yarn tries to reach a state of equilibrium in which twists in the opposite direction from the original twist direction balance the yarn's torque.These twists are also called negative twists. In this state of equilibrium, the inner torsional tensions cancel each other out. The thread always buckles at a spot where the cross section is small due to the unevenness of the thread. During the spinning process this spot took up more twists and is therefore subjected to higher inner tensions, which ultimately break the thread core. Although thicker yarns are less twisted than fine ones, the inner tension rises opposite to the yarn size. Smaller yarn is more weakened by steaming. Further positive aspects of steaming are the reduction of curling and, at the same time, the setting of the physical properties of closeness and extension imparted to the yarn by twisting.

Synthetic fiber



Fiber strength and elongation
1. amorphous fiber domains
2. crystalline fiber domains
3. bonding force

Synthetic fibers can be divided up into two fiber domains, the crystalline (organized) domain and the amorphous (unorganized) domain. In crystalline domains physical forces of attraction are acting between the closely parallel lines of polymers. These forces acting transversely to the fiber axis make up the closeness of a fiber. If tension is applied to the fiber, these forces hinder the fiber from breaking.

In contrast, the amorphous fiber domains act like links of the fibers. They are responsible for the flectional strength of the fibers. Additionally, the amorphous fiber domains make it possible for water or dye to enter.

crystalline fiber domains → **tensile strength elasticity**

cause

amorphous fiber domains → **flexibility water absorption colorability**

During steaming, the heating of the fiber causes its molecules to start oscillating. The increase of oscillation that can be influenced by the degree and the period of heating dissolves the electric bond forces in the fiber; at first in the amorphous domains, later in the crystalline ones and at last in the polymers. As with wool, the tensions brought in by spinning are set free. During drying or cooling of the fiber, the binding forces are rebuilt without having tensions in the inner part.

The problem of synthetic fibers is that the reduction of the binding forces only takes place between the so-called deformation point (start of changing the firm - solidified - amorphous fiber domains into a visco-elastic - easily deformable state) and the distortion point (the crystalline fiber domains change into a visco-elastic state, too) which is in a relatively high temperature range.

Glass transition temperature - and deformation point of artificial fiber

Material	Deformation point	Distortion temperature
Polyester	80-85 °C	230-240 °C
Nylon 6	80-85 °C	180-200 °C
Nylon 66	90-95 °C	220-235 °C

Several different heat setting processes are known in the textile industry. The most important are

AUTOCLAVE HEAT SETTING

The oldest heat setting process is autoclave heat setting. Mostly, it is a discontinuous process. Autoclave installations use vacuum and/or pressure. Textile material is brought into the autoclave either on bobbins, in skeins or loose in a container. As nearly all autoclaves are exposed to certain pressures they are usually built in cylindrical shape and mounted horizontally. Most commonly, autoclaves are loaded and unloaded from the end of the cylinder but some may be loaded from one end and unloaded from the other end. Autoclaves mounted vertically exist but are less common.

STEAMATIC PROCESS

For automation in link spinning/winding there is the so-called "in-line steamer". The first known process of this type is the Steamatic process by Resch. In this case the heat setting process happens in between the ring spinning and the winding machines. As soon as the ring spinning frame has finished spinning, the loaded bobbins are transported into the in-line steamer. Those bobbins are steamed there with a vacuum method and dried again within seconds. After steaming and drying, the bobbins are transported on to the winding machine where they are re-wound onto a cross-wound package.

The carpet industry currently utilizes two continuous processes, the Power-Heat-Set process and the TVP process which was derived from the autoclave technology.

POWER-HEAT-SET TECHNOLOGY

The Power-Heat-Set process, formerly known as Suessen process, was developed in the beginning of the 1970s and was the first continuous heat setting system worldwide. The process itself was revolutionary in that it was the first system not operated with saturated steam and pressure, but with a superheated steam/airmix at atmospheric pressure. Using this innovative technology, completely new carpet collections were created. In the Power-Heat-Set process, the yarns and filaments oxidize slightly on the surface due to the existing oxygen in the surrounding atmosphere and the higher temperatures. This capillary oxide film causes the complete carpet later to be more stain resistant. Dirt particles adhere less to the fibers.

SUPERBA TVP PROCESS

In addition to the Power-Heat-Set technology there is the SUPERBA TVP3 process which is also a continuous process. In the TVP3 process yarn is placed on a conveyor belt and inserted through a lock into a pressure tunnel that could be up to 15 m long. Inside the tunnel, it undergoes a heat setting process with saturated steam. At the end of the tunnel the yarn is taken out through a second lock. The yarn which is still hot and moist is dried and cooled after heat setting and fed to the winding process. Up to 72 yarn ends can be processed at the same time.

WOOL CARBONISING

Carbonising is the chemical process which is used to remove vegetable matter (VM) from wool. The VM, which may be seeds, burrs, grass etc., is predominantly made up of cellulose, hemicellulose and lignin whereas the wool is principally protein. The carbonising process makes use of the difference in the stability of proteins and cellulose to the effects of mineral acids. Cellulose is made up of carbon, hydrogen and water with a chemical formula of $C_6H_{10}O_5$. It can be seen from the formula that the hydrogen and oxygen are present in the same ratio as they are in water. Therefore, in considering the underlying principle of carbonising, it may be assumed that all the VM consists of carbon and water in certain proportions. If these two substances are separated the latter can be evaporated away leaving the carbon in a brittle form. The most commonly used acid for this purpose is sulphuric acid. In its simplest form, carbonising follows a traditional wool scouring process and consists of acidification, drying, baking, mechanical crushing and dusting, neutralisation and final drying. This basic process of loose wool carbonising has remained essentially unaltered for many years.

Carbonising is primarily used for treating card waste, noils and high VM wools which are destined for subsequent processing via the woollen route. Very little processing of wools for worsted production is carried out. Where the VM content is from medium to low, say a maximum of 2-3%, mechanical removal of the VM is usually adequate with the various stages of carding, gilling and combing in the worsted process being sufficient to produce a speck free top. The machinery used in woollen processing generally cannot accommodate medium to high levels of VM. Low to medium levels of VM can be accommodated if the spun wool is to be processed into a fabric which will subsequently be carbonised in the piece.

In the first half of the 20th century a considerable amount of research was carried out by various workers whose prime aim was to minimise the chemical damage imparted to the wool fibre by the acidic conditions. Various alternatives to sulphuric acid were proposed, such as calcium chloride, hydrochloric acid, aluminium chloride and thionyl chloride to name but a few. Commercial operators have in general, though, stuck with the sulphuric acid process due to its cheapness and ease of control. During the 70s and 80s some fundamental research was being carried out on such topics as acidising conditions, drying and baking, effect of detergents and rapid test procedures at DWI in Aachen as well as in Australia. In more recent times, though, this important area of wool processing has seen no new work published.

PROCESSING STAGES

The conventional technique of wool carbonising has the following basic steps:

1. Scouring of the raw wool with non-ionic detergent.
2. Rinsing.
3. Immersion in a long bowl containing 5-7% (w/v) sulphuric acid, 1-2 g/L detergent at 20-30°C.
4. Double squeezing and/or continuous centrifuging prior to drying.
5. Drying at 60-80°C to a low regain.
6. Baking at 95-120°C to carbonise the VM.
7. Pass through heavy fluted rollers to crush the embrittled VM.
8. Convey to a rotating shaker/de-duster to remove the charred VM dust.
9. Pass through a neutralising bowl usually containing sodium carbonate.
10. Rinsing with a small addition of detergent.
11. Bleaching with hydrogen peroxide at approximately pH 5 with formic acid.
12. Final drying.

The production rate through the process is usually low, typically 500-600 kg/h for an 1800 mm wide line, since sufficient time must elapse for the VM to adsorb the acid from the bowl and for subsequent baking to embrittle the acidified cellulose,

RECENT DEVELOPMENTS

As noted earlier very little in the way of research into the carbonising process has been conducted in more recent times. What work that has been done in the latter part of the 20th century is summarised below.

- Acidising
    - Stainless steel replaces wood for bowl construction
    - Use of wetting agents to improve and even out uptake of acid
    - Alternative acids (aluminium chloride, HCl, thionyl chloride etc)
- Moisture removal
    - High pressure squeezes
    - Double sets of squeeze rollers
    - Continuous centrifuges
- Drying/Baking
    - Lower temperature drying preceding baking to minimise chemical damage
    - Moisture control systems for more even drying and energy conservation
    - Two stage baking
    - Intermediate crushing
- Burr crushing and dedusting
    - Multiple stage crushing and step dedusting
- Neutralisation
    - pH control
    - Alternative neutralising agents (eg ammonia, ammonium carbonate)

TYPICAL PROBLEMS

Preparation/Scouring

- Degree of opening
- Poor scouring

Acidising

- Yellowing of wool

- Localised damage
- Ineffective carbonising

Moisture Removal

- Poor squeeze efficiency
- Uneven moisture content

Drying and Baking

- Yellowing of wool
- Poor carbonising of VM

Burr Crushing and Dedusting

- Fibre breakage
- Loss of fibre
- Poor crushing
- Poor dedusting

Neutralisation

- Wool pH too low
- Wool pH too high
- Ineffective bleaching

WEIGHTING OF SILK

Silk is sold by weight. By means of weighting the manufacturer can increase the weight of silk by 3 to 4 times. The weighting substance in the silk includes tannins such as salts or iron, tin (mostly used), chromium, sodium, magnesium and barium. Also sugar (mostly used), glucose, gelatin, glycerin and paraffins are used.

HOW WEIGHTING IS DONE

Silk has great absorptive power. It can take upto 50% of tannin. Once that is applied the tannin itself can attract salts of iron and tin by another 50% without any visible indication of being changed in character. For dark colored silks, iron salts are used, for light-colored silks, tin salts are used.

For applying weighting, the silk is first degummed. During degumming process, silk loses approximately one-fifth of the weight. This is done prior to weaving. Then it is immersed in a solution of catechu or some other substance rich in tannin. Then it is tranferred from tannin vat to iron or tin baths. After this cloth is taken out and washed in pure water.

EFFECTS OF WEIGHTING

Weighting causes the fabric to lose its strength as soon as the weighting is applied. Heavily weighted silk must be made into garments as soon as it is made. Spots develop in the dyes. Saltswater, perspiration and tears cause spots to be formed which seems as if the silk is eaten by acids. Sunlight also attacks weighted silk and can cause silk to fall to pieces.

HOW TO DETECTED WEIGHTING IN SILK :

Weighting of silk can usually be detected by the burning test. Separate threads from the warp and the weft are set on fire with a burning match. Pure silk burns very badly and stops burning as soon as the burning match has been removed. Practically no ash is formed (less than one per cent), and the end of the fiber left unburned takes the shape of a little bulb.

Weighted fibers, when burned, leave a considerable amount of ash, and the entire thread may keep its shape after being burned. When only the filling or the warp is weighted, applying the flame to a sample of the cloth seems to consume only one set of threads, the unweighted ones, the others keeping their form because of the heavy ash content.

SAPONIFICATION:

Vegetable oils, animal fats and mineral oils are not soluble or miscible with water. The vegetable oil, which is immiscible with water, is glycerin of fatty acids like oleic, satiric, plasmatic ricinoleic acids. When such oil is heated with a solution of sodium hydroxide in water, the oil is split up into its constituents, fatty acid and glycerin of which the latter is freely miscible with water. The fatty acids react with sodium hydroxide present in the solution forming its sodium salt i.e., Soap, which is also soluble in water. This reaction is called saponification. As a result of Saponification, the insoluble and water-immiscible oil is converted in to water-soluble products.

EMULSIFICATION:

Waxes present in the size cannot be removed by saponification. There are esters of higher fatty alcohols and fatty acids. These oils are also are hydrophobic in character. This can be removed by forming its emulsion in the Kier liquor. Therefore, an emulsifying agent (soap) is added to the kier liquor. An emulsion is a fairly stable mixture of two liquids, which normally do not mix with each other. Waxes + Soap (already formed by saponification) suspension.

WET PROCESSING EQUIPMENT

KIERS

The materials present in the cellulose have to be removed from the fabric by another process called as scouring process. It is also called as kiering, kier boiling and boiling out etc. Boiling out is carried out in a boiler in which yarn or cloth is boiled with alkaline liquors. This boiler is called as 'Kier' and hence the terms kiering and kier boiling.

TYPES OF KIERS:

The following are the different types of kier.

1. Open kier. ✓
2. Closed kier. ✓

Some of them are vertical and others are horizontal. Depending on the methods of heating. Kiers are divided into 3 types viz.,

- i) those heated by direct steam within the kier; ✓
- ii) those heated by indirect steam (closed coil) within the kier and ✓
- iii) Those heated by indirect steam outside the kier ✓

In the first type, the rate of heat transfer from the steam to the liquor is maximum because of its direct contact but there is condensation of a part of the steam which dilutes the liquor and also increases the volume of the liquor, generating hydraulic pressure. Also steam beings with it some amount of air (oxygen) which was dissolved in water.

This oxygen degrades cotton. Hence hydrazine (H_2N-NH_2) is added to the water, which consumes the dissolved oxygen as $H_2N-NH_2+o_2$ □ N_2+2H_2O

In the second type, the liquor is heated with closed steam coils inside the kier and therefore the efficiency of heat transfer is lower than that in the first type but there is no dilution of the liquor not increase in its volume and no increase in pressure.

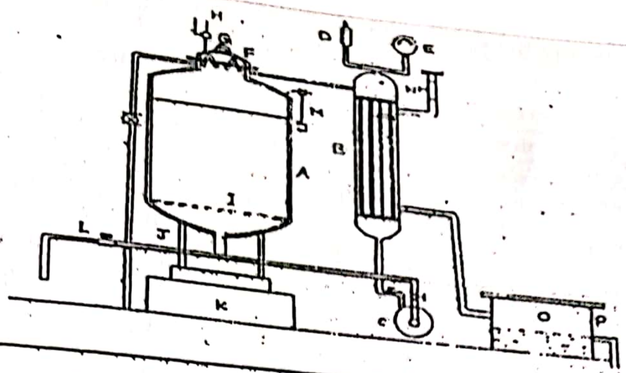
The third type is similar to this except that the liquor is heated outside the kier.

OPEN KIER

Certain goods containing colored effect threads i.e. fabrics containing dyed yarns for warp and weft along with white yarns for producing colored woven designs, as in saris, dhotis, shirting checks etc., are boiled in open kier since most of the color of these threads is destroyed in boiling and bleaching. In the handloom industry, most of the grey yarn is also boiled in the open kier or in open vats under atmospheric pressure using 2%caustic soda, 1% soap and 1% sodium silicate (on the weight of the material) using ration of 1:20 for 4 – 6. Hours taking care to see that the yarn remains immersed in the liquor throughout. It is left overnight in the liquor, and washed thoroughly with water the following.

PRESSURE KIER BOILING:

A kier is a cylindrical vessel (generally vertical) capable of holding 1 to 3 tons of cloth. A 2 ton kier 2.7 m. (or 9 feet) height and 1.95 (or 6 ½ ft.) In diameter is commonly used for boiling. Horizontal kier are also used. Either open kier or pressure kiers are in use. When the lid of the kier is removed, it serves as on open kier working at atmospheric pressure. Kiers are made of mild steel plated 0.6 cm. thick joined by welding or riveting. They are provided with a pressure gauge and a safety value. High pressure kier have manholes through which cloth is introduced. As the kier is made of iron, a lime wash (with lime, cement, and sodium silicate) is given to its interior to avoid formation of rust stains on the cloth which comes in contact with the inner kier.



Parts:
A- Kier
F- Lid
K-Foundation
P- Outlet for condensed water
B- Heater
G-Handle
L-Drain Valve
C- Centrifugal Pump
H-Block-off Cock
M-Liquid valve Indicator
D-Safety Valve
I-False Bottom
N-Steam trap
E-Pressure gauge
J-Supports

LOADING OF KIER

They grey fabric after desizing is loaded into the kier by piling uniformly either by automatic piling or by manual piling, with manual piling; it is possible to load about 80% of the kier capacity whereas with automatic pliers (which is used in modern kiers) about 70% capacity is utilized. The kier should not filled beyond 80 and 85% of its rated capacity as overfilling may create hydraulic pressure and would also compress the fabric at the top of the kier, hindering the circulation of the liquor thereby increasing the temperature gradient between the top and bottom of the kier. Small quantities of cloth should not be boiled in a large kier; the kier should at least be half-full; otherwise the cloth may entangle. In the case of hands the good are usually linked together in a continuous chain or headed up in the form of small bundles. It is most important to ensure even and regular packing of the goods in the kier. After the material is piled in the kier, heavy stones are placed on it to prevent it from being tossed up during boiling. (Jute cloth may be placed between the material and the stones) Before entering the kier, the cloth may be impregnated with alkaline liquor in a trough and mangled to ensure even treatment of the cloth.

REMOVAL OF AIR FROM KIER

After loading the fabric in the kier, liquor is let-in from the bottom of the kier to sweep out air. The material liquor ratio (M.L.R) in a kier is usually 1:4 or 1:5. There should be enough kier liquor for the efficient circulation by the pump. Air is often, removed by heating the liquor; allowing it to come from the bottom, closing the lid and by keeping the air valve open allowing it to come out through the air valve without operating the pump.

After opening the air valve direct steam is turned 'ON' when the liquor boils and expels the dissolved air. Subsequently direct steam is stopped and the air valve closed. Only partial air is removed this way. For satisfactory removal of air, the liquor should be circulated for 15 minutes. And the circulation stopped and restarted when the kier liquor starts coming out form the air valve. Completes immersion of the material and the removal of air is most essential in order to prevent formation of oxy cellulose which is rapidly produced by the action of air on cotton.

For kier boiling, a mixture of 1 to 1.5% caustic soda solutions, 1% sodium silicate, 1% soap on the weight of the materials is used along with any heating assistant, boiling under 1.5 kg per sq cm (20 to 30psi) pressure for 6 to 10 hours is adequate for most goods but this varies depending on the type of fabric. Most goods which are to be sold in the white state are boiled twice, first with sodium hydroxide and then with sodium carbonate. It takes normally 2 hours to reach the required pressure in the kier.

STEAMERS

moisture can be absorbed
thoroughly soaked.

CONTINUOUS STEAMERS:

The high temperature Festoon steamer works with saturated or super heated steam at a temperature of up to 180 C. two sections of this steamer are shown in the figure.
The steamer consists of an inverted box, which is open at the bottom (top of the box). The steaming chamber consists of hallow walls and a hollow ceiling in which constant level of water is maintained. The hollow wall contains heating pipes which boil the water the help of steam or oil as a heat transfer medium. A saturated steam produced rises, expels in the air and heats the wall. The insulated exterior wall prevents the heat loss and also prevents condensation of water drops. Heated pipes are fitted in the double wall roof to prevent the formation of water drops. A slit is provided to the inner wall at the apex of the roof from which steam enters in the inner chamber. Inside the steamer about 18” above the bottom edge there is an extraction device to draw excess steam and prevents it from escape it. The steam is continuously purified to remove the harmful printing paste, additives like urea, benzene, alcohol, solvents etc.,

The fabric is lifted in a tension free state over a conveyor into the steamer. Saturated steam may be used to preheat the fabric. The cloth is transferred in a tension free state to a continuous chain of rollers. The loops of fabric can be readily adjusted to any length. The cloth leaves the steamer at the same end as it is entered it. During steaming the printed surface of the cloth does not come into contact with any metallic parts.

An advantage of his steamer is that it is not dependent of the quantity of the steam supplied by the boiler, since steam generation and distribution occurs in the steamer itself. Continuous processing of all types of fabric constructions, all types of dyes can be used in this process. Simple running control and extremely good reproducibility of steaming conditions are some of the other advantages.

STEAMERS:

Printed dyes are usually fixed by steaming process, the steam provide the moisture and rapid heating that brings about the transfer of dye molecule from the thickener film to the fiber within a reasonable time. The terms ‘ageing’ and steaming refer to the same process of fixation. The time and conditions required for fixation in steam vary with the properties of the dyes and fibres used, ranging from 10 seconds to 60 minutes in steam at 200° to 100°C.

Technical and economic factors have encouraged the use of higher temperature and shorted time and the change from batch to continuous processes.

BATCH STEAMERS:

For expensive fabric and small quantity there are obvious advantages in using steams of low capacity, that can be quickly raised to working temperature and that produce no creasing, stretching and other damage to fabric. Batch steamers also advantage when colour yield are improved by steaming at above atmosphere pressure for example in the case of deep colours on polyester fabrics.

The following are the various dye fixation processes after printing of polyester fabrics.

1. Atmospheric steaming: ✓

This method does not require a pressure vessel, but in order to obtain moderate-good yields of dye a "Carrier" must be added to the print paste. Steaming up to 1 hour is carried out at atmospheric pressure.

2. Pressure steaming: ✓

A steaming treatment of form 20 – 30 minutes at a pressure of 2.0 X 105 – 1.4X105 N/M2 (30 – 20 lbs/in2) is given method no carriers are necessary but the steamer must be capable of operating safety at much pressures.

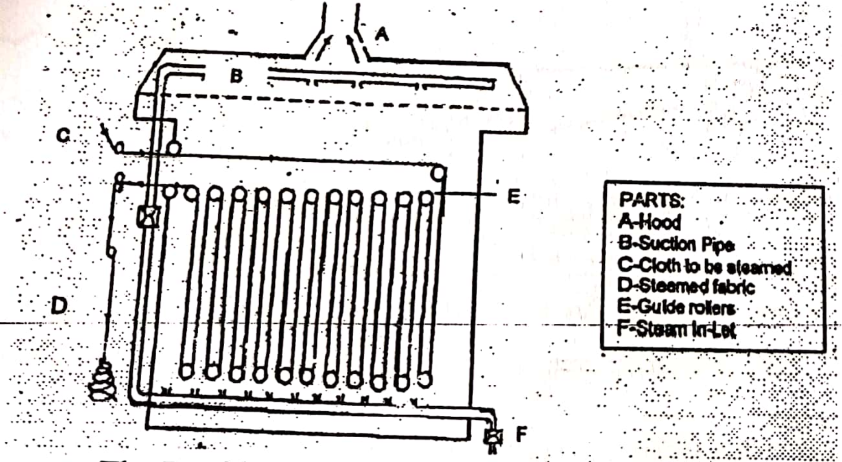
3. High temperature steaming: ✓

The ICI high temperature steamer uses superheated steam to obtain accelerated dye fixation. The print paste contains an addition of urea which aids dye transfer to the polyester fiber. High temperature steaming is a continuous process and no pressure seals are necessary. For 'Terylene' or polyester fabrics, temperature up to 180°C are usually employed with a treatment time of one Minutes.

4. Dry Heat (backing) Fixation: ✓

An addition of 100 parts of urea per 1000 parts of print paste and the use of an emulsion thickening is recommended. This method operates at the highest temperature range of 180°C - 200°C and at times of 120 – 30 seconds respectively.

The rapid ager:



The Rapid agar consists of a small iron chamber with the guide rollers at the top and bottom. A wooden hood is provided at the top of chamber to carry off fumes during steaming. The printed cloth enters and leaves the ager through the sane aperture. Two heated pipes parallel to the weft thread of the cloth are fitted near the aperture or prevent condensed water drops from steam falling on cloth. The steam is supplied from perforated pipes fixed at the bottom of the agar. The condensed water formed from the steam runs down the sides of the camber and collects on the floor and is cleaned of from time to time. Goods printed with vat dyes, vat resists Rapidogen resist etc. are steamed in the rapid agar for 5 to 10 minutes at 100 to 102°C the consumption of steam in this agar is very high and thereforethe operation is expensive. Rapid agar is not suitable for light weight goods because of the stress extended on the fabric.

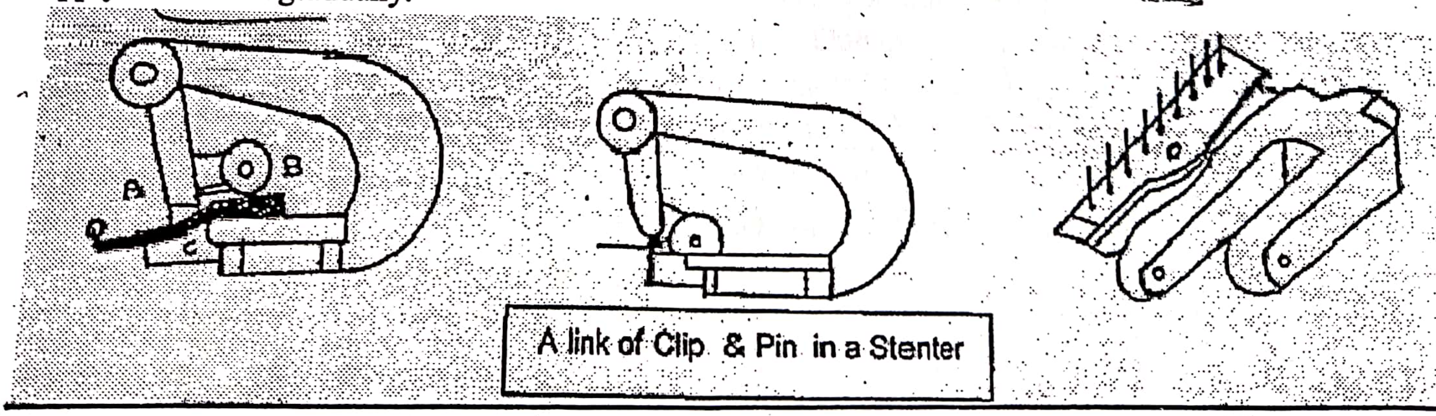
Stenter

STENTER

The fabric after scouring and bleaching process shrinks widthwise and the weft becomes distorted during this process. The main function of stenter is to stretch the cloth widthwise and to recover the original width. It also straightens the weft threads and passes it at right angle to the warp. But in majority of the cases, a stenter does stretching and drying. There are two types of stenters.

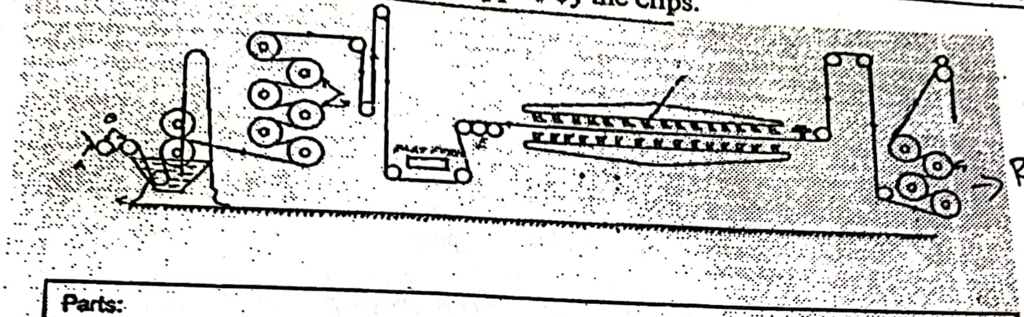
1. Clip stenter, ✓
2. Pin stenter. ✓

Clip stenter is used for cotton and linen fabrics. They can be run at a higher speed than a pin stenter. Pin stenter are used for delicate fabrics like woolen, worsted, silk, rayon and synthetic which are discarded by the grip of clips. Single layer pin stenters are used for silk, rayon and synthetic fabrics. Multi layers pin stenters are used for woolen goods. These goods being thicker, require greater amount of heat and hence a longer passage through the machines. the stenters stretches the fabric and also dries. The cloth is dried, stretched and free from cases. There is a control over the width and also over length wise of stretching during drying which is not in any drying unit. A hot air stretching range is shown in figure. The cloth passes under the platform to the entry end of the stenter, where two at tenders remove any ceases and control the feeding into the clips or the standers may have some automatic method of feeding the fabric to the clips stenter the cloth is gripped by the clips at either selvedge. The chains of clips for the first 10 feet of rails gradually diverse from each other and thus apply the stretch gradually.



A link of Clip & Pin in a Stenter

The cloth is carried by the clips in the stretched condition for the length of about 80 feet. Hot air is blown on to the cloth by a powerful fan through sheet iron and trucking and adjustable nozzle. A large multi tubular heater is used for heating the air. Sometime steam is used as a heating medium (Cylinder drying). According to the quantity of air required the heater is built up of a number of separate sections. It is there for possible to work at the same time, both with steam and with exhaust steam. (The air can be when partially heated in the front section fed by exhaust steam are raised to required temperature in the smaller section behind which are fed with steam.) Hot air is delivered through nozzles above and below the cloth, or on to the underneath side only. The nozzles can be adjusted to deliver the air towards or against the direction in which the cloth is moving towards the selvedge of the centre and the nozzles are fitted with adjustable dampers on leaving the clips, the material heavy texture, it is passed over. There are 4 drying cylinder to remove any moisture which may retain in the selvedges, where they have been gripped by the clips.


-> Removes the Moisture

Parts:
A-Fabric B- Tension Rollers C-Starch mangle D&G- Drying Cylinders
E-Expanded Type Guide Rollers F-Hot air Blower

The hot air from the chamber is recalculated through the fan and heater thus there is economy is steam consumption. The output of this machine depends on the weight of cloth and the amount of moisture to be dried. Usually these machines are made with a 90 feet length of clip and the speed range up to about 120 yards/ minutes.

Suggested Question

1. Explain about Typical Textile sequence.
2. Briefly describe about Singeing, Desizing, Scouring & weighting of silk.
3. Explain about wet processing equipment and its types.

Faculty Sign HOD Sign

Unit 2

Mercerization – Theory process - Methods – Chemicals – effects. Bleaching – Hypo chlorites – Hydrogen peroxide – sodium chlorite. Equipments and chemicals for bleaching of cotton, viscose, cotton/ viscose Polyester/ cotton. Evaluation of bleached fabric – whiteness – absorbency – chemical damage – residues

BLEACHING

ching:

→ All the impurities can be removed in scouring process.

→ But the natural colouring matter cannot be removed.

→ This coloring matter is removed by bleaching.

→ There are 2 types → oxidising bleaching agent
→ Reducing bleaching agent.

• Reducing bleaching agent:

→ It helps to remove the natural coloring matter.

→ But it brings back the original state of natural color when it has contact with air.

→ In past, it is used for wool + silk.

• oxidising bleaching agent:

→ This gives more permanent white to the material.

→ Today, almost all textiles bleached by this method.

* The source of the color:

→ The source of the natural color may be

- (Base) Flavone pigment incase of cotton. [reason for that coloring matter]
- Soil + dirt acquired from atmosphere.
- contact with plant parts or seeds.
- colors acquired during mechanical processing (oil, grease)

objectives of bleaching:

→ It is to destroy the natural (or) acquired color to bring the textiles in a white state.

→ This may be necessary when:

- Fabric has to be supplied in white colour.
- It needs to be dyed in pastel shades.
- It needs to be printed.

→ Dyeing unbleached fabric in pastel shades
- reduce the brightness of the fabric

→ Bleached fabrics given treatment with optical brightening agent.
- This confers extra brightness to the fabric

→ It also removes residual impurities left by
- desizing, scouring etc.

→ It also increases the absorbency of the fabric.

* **Main bleaching agents:**

→ The main bleaching agents are
- → Sodium hypochlorite (NaOCl)
- → Sodium chlorite [$NaClO_2$]
- → Hydrogen peroxide [H_2O_2]

BLEACHING WITH SODIUM HYPOCHLORITE:

→ It is necessary to remove natural colouring matter from the fabric.

→ It can be achieved in many ways. They are
- By using dil. hypochlorite solution at room temperature.
- By using Hydrogen peroxide at 80–85°C
- By using sodium chlorite at boil.
- By using peroxy compounds like acetic acid.

- **An efficient bleaching properties:**

→ An efficient & proper bleaching must ensure.
- Pure & permanent white.
- Levelling Dyeing properties.
- There should not be any tendering of material during bleaching.

ypochlorite:-

ium hypochlorite is a salt of hypochlorous acid.
doesnot exist in solid form.
It can be prepared in an aqueous solution.

→ sodium Hypochlorite consists of 14-16% of available chlorine.

→ It loses its strength when packed in air tight container.

- **Properties:-**

→ It consists of 14-15% of chlorine.

→ In air tight container, loses its strength.

→ Solution will be stable, if kept away from the sun.

→ It undergoes decomposition rapidly, if this condition not maintained.

- **Manufacturing of sodium hypochlorite:**

→ It is manufactured by

- dissolving chlorine in a solution of Sodium carbonate (or) sodium hydroxide

$$\boxed{\begin{array}{l} 2NaOH + Cl_2 \rightarrow NaOCl + NaCl + H_2O \\ Na_2CO_3 + Cl_2 \rightarrow NaOCl + NaCl + CO_2 \end{array}}$$

→ oxidising agents forms oxycellulose by reaction with cellulose. [cellulosic fiber- cotton]

→ cellulose forms the base for the plant fibers.

- **Oxycellulose:-**

$$\boxed{\text{oxidising agent} + \text{cellulose} \longrightarrow \text{oxycellulose}}$$

→ oxycellulose are of 2 types → high reducing power
→ great affinity for basic dye.

- **High reducing power:**

→ It is under acidic conditions.

→ Under acidic conditions ⟹ hypochlorite oxidation of cellulose

⟹ produces oxycellulose ⟸ with high reducing power & high alkali solubility

→ under alkaline conditions
↳ hypochlorite oxidation of cellulose
↳ produces oxycellulose
↳ with great affinity for basic dye.

→ pH of hypochlorite solution determines
- type
- nature

} of oxycellulose formed

- **Stability of aqueous solution depends on**
  - → Temperature
  - → pH
  - → concentration
  - → presence of impurities
  - → Storage conditions [exposed to light or not]

- **Decomposition of NaOCl:**

→ NaOCl decomposes at favourable conditions.

→ It undergoes self decomposition. ~~as foll~~

$$2NaOCl \rightarrow NaCl + NaClO_2$$

- **Remedies for self decomposition:**

→ Because of self decomposition, suitable storage conditio are
- alkalinity (not acidic) about 2N.
- temperature 0 - 5°C
- concentration about 100 g/l available chlorine.
- Away from sunlight.

Notes to Remember!

→ pH determines acidic nature

→ It ranges from 1 to 14

→ In this, 7 is considered as middle

→ If the value is above 7, it is alkaline.

→ If it is below 7, it is acidi

→ Number 1 is considered

effect.

ng process of Bleaching:

→ when cotton goods are to be bleached, ③

- they are scoured & Packed into a Vessel.
- The vessel may be wood, stone (or) stainless steel.

Parts of machine:

→ It consists of a rectangular (or) cylindrical vessel.

→ This vessel consists of Perforated false bottom [Perforated – Holes]

→ It has an outlet [வெளியேறும்] to a sump [குழி]

→ This sump [Pit / குழி] has the same capacity of the vessel.

- **Sump:-**

  → Bleaching liquor is prepared in this sump.

  → Liquor is prepared in desire concentration of chlorine
  ↓
  with sodium hypochlorite solution.

→ It is then pumped up.

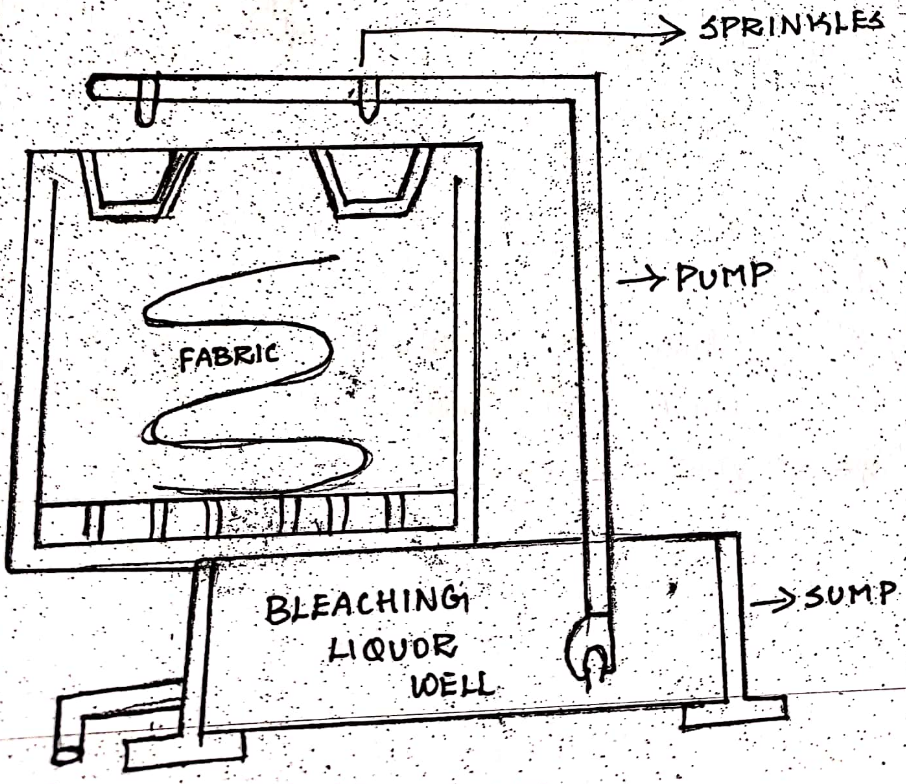
→ It is spreaded through fabrics by sprinkling.

→ It is sprinkled over the top of cotton goods.

→ It percolates [வடிதல் / Filter] into the sump again.

→ The process is repeated till required bleaching obtained.

HYPOCHLORITE BLEACHING UNIT



Effects of sodium hypochlorite:

→ Effects of sodium hypochlorite can be determined by following conditions.

- time of contact
- Effect of temperature
- Effect of pH

• Time of contact:

→ Longer the time of contact with cotton material by oxidising agent

- larger amount of oxygen transferred
    - to cotton
    - from solution

→ With
- proper temperature
- pH
- Concentration
- time of contact

} good bleaching is obtained.

• Effect of temperature:

→ Bleaching is more rapid [speed] at high temperatu

→ Hypochlorite solutions are stable at boil temperatu

→ pH values are of 11 or higher

→ The solution decomposes at lower pH value.

• Required elements:

→ Because of this decomposing property,

- Bleaching is accelerated
- at elevated temperature
- Carried out at not less than pH value of 11

• Effect of pH:

ODIUM CHLORITE:-

→ Sodium Chlorite is an universal bleaching agent.

→ It is used for bleaching all types of synthetic fibres.

→ It is a safe bleaching for cotton.

→ It can be used over wide range of conditions of:
- time
- temperature
- acidity
- alkalinity.

→ Sodium chlorite marked under trade name "TEXTONE"

• conditions for bleaching:-

→ For cellulosic material:-
- TEXTONE used under acidic conditions
- at elevated [higher] temperature

[or]

- with hypochlorites
- at room temperature

→ No chlorine is liberated at these processes.

→ These reactions gives chlorine dioxide.

• chlorine dioxide:-

→ chlorine dioxide causes bleaching agent action

→ Speed of bleaching
- depends on PH.
- It is more fast as PH falls.

• Usage of sodium chlorite:

→ It is generally not used for cotton bleaching.

→ It is costly

→ It evolves chlorite which is dangerous
- for worker's health.
- also effects the surface of the machine by corrosion.

→ In case of synthetic fiber,
- used as no other effective bleaching agent.

- **Functions of Sodium Nitrate:**

→ Sodium nitrate is added to the bleaching bath.

→ Bleaching is carried out in stainless steel bath.

→ It prevents the material of machine from corrosion.

→ So, it is best to add sodium Nitrate with
- sodium chlorite
- to prevent corrosion.

BLEACHING WITH HYDROGEN PEROXIDE

[H_2O_2]

→ Hydrogen peroxide bleaching is a costly process.

→ Chemicals used in peroxide bleaching is of higher cost.

→ It is costlier than hypochlorite bleaching.

→ But peroxide bleaching has certain advantages.

Advantages:

→ In hypochlorite bleaching:-
- It is essential to remove all the impurities from the fiber.

→ In peroxide bleaching:
- Process is carried out in alkaline liquor at boil.
- Scouring & bleaching can take place simultaneous

Properties of H_2O_2:-

→ Hydrogen peroxide clear syrupy liquid.

→ It is colourless in small quantity.

→ It appears bluish in bulk quantity.

→ Pure hydrogen peroxide is fairly stable for several weeks.
- If it is kept away from sunlight.

→ In presence of alkali, Hydrogen peroxide decomposes
- with liberation of oxygen.

They are more stable in presence of → sulphonic acid
→ phosphoric acid.

Addition of → alcohol (or) → glycerine } also stabilizes hydrogen peroxide.

Effect of Temperature:

→ As Temperature ↑ increases
- stability of H_2O_2 ↓ decreases

→ For cellulosic (or) Man made fibres
- time for bleaching would be too long
- at temperature lower than 80°c.

→ In normal practice, bleaching is carried out at 90 to 100°c.

→ in pressurised machine, temperature up to 130°C.

→
- oxygen will evolve from water
- collect at the top of enclosed vessel.

→ Presence of this oxygen in contact with cellulosic fibres
- in alkaline state
- at high temperature
- lead to formation of oxycellulose
- causes tendering.

→ If precautions are taken to permit the
- escape of free oxygen
- It is possible to bleach in periods
- as short as 20 minutes
- after reaching maximum working temperature
- in pressurised vessels.

Catalysts :-

→ The metals & their oxides catalytically (boosting agent)
- decompose hydrogen peroxide.

→ catalytic metallic ions causes
- increased degradation of cellulose.

* Stabilizers :-

→ sodium silicate forms thick with metallic ions

→ These complexes have powerful catalytic effect

→ So, sodium silicate has excellent stabilizing effect

→ presence of proteins increases the bleaching process in safety manner

• Advantages :-

→ sodium silicate is cheaper in cost.

→ It is highly efficient.

→ It can be handled easily.

• Disadvantages :-

→ It is not suitable for continuous process.

→ It forms insoluble compounds on the equipment surface.

→ It also causes abrasion of clothing (or) cloth
  • that comes in contact with sodium silicate

→ It is difficult to remove the stains obtained
  • during this process.

• Remedial measures :-

→ To overcome this decompose problem
  • Sodium silicate replaced by phosphates.

• Effect of Alkali :-

→ In presence of acid (or) neutral solution,
  • H_2O_2 not an active bleaching agent
  • for cellulosic material.
  • This is because of slow liberation of perhydroxyl ion.

→ If alkali is used excess
  • It causes ~~instability~~ instability / decomposition } by production of oxygen.

→ Increase in alkalinity, decreases the stability of H_2O_2.

→ When Sodium silicate as stabilizer,
- harshness is caused by decomposition
- of insoluble silicon compounds.

→ It causes trouble in package dyeing machine.

Effect of cotton impurities:-

→ Water insoluble impurities in raw cotton
- have considerable stabilizing effect.

→ This effect is lost
- If cotton is scoured by prolonged boiling
- with sodium hydroxide.

→ If the material is not with more impurities
- It is advisable to bleach
- unscoured cotton.

→ If scouring is unavoidable
- the treatment should be mild.

- Effect of water:-

→ Sodium silicate to act as stabilizer.
- magnesium salt should be added.
- It is made possible using hard water.

→ Water having hardness between
- 2° to 7° gives good results.

→ For cold water process,
- 0.1 to 0.2 g/l of magnesium sulphate is added

Preparation for Bleaching:

→ Some enzymes cause * catalytic decomposition of H_2

→ If those enzymes are used in enzymatic desizing
- thorough rinsing of goods is important.
- This avoids catalytic decomposition of

- Pretreatment:

→ Goods may be pretreated with hydrochloric acid

→ Hydrochloric acid partially ~~decompose~~ hydrolyse
- size mixture [starch]

→ It also removes
- calcium
- magnesium

} Present in the fibre.

→ In J-box, due to continuous process
- 2% of hydrochloric acid used.
- Because dwelling [நனைதல்] period is of 30 to 60 mins

→ If soaked in pits, for overnight,
- Concentration of H_2O_2 reduced to 0.2 to 0.3%.

→ During dwelling period,
- goods should be covered with
    - plastic sheeting.