TEXTILE PROCESSING TECHNOLOGY

Level-I

Based on February, 2022, Curriculum Version 1

Module Title: - Performing Pretreatment Operations

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Acknowledgement

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Acronyms

SOPs - SOPs Standard operating procedures

WHS - WHS Work health and safety

PPE - PPE Appropriate personal protective equipment

WHS - WHS Work health and safety

DSE - DSE Display Screen Equipment

OBA - OBA Optical Brightening Agents

MLR - MLR Material Liquor Ration

PH - PH Potential of Hydrogen

Introduction to the Module

In the field of Textile Processing Technology; understanding the concept pretreatment operations helps to understand trainees about the knowledge, attitudes and skills required to conduct pretreatment of textile materials to make them ready for dyeing and printing operations. This module is designed to meet the industry requirement under the Textile Processing Technology Occupational standard, particularly for the unit of competency: **Perform Pretreatment Operations.**

This Module Covers the Units:

- Requirements for a pre-treatment operation
- Pre-treatment processes
- Pre-treatment machines & equipment's
- Remove product and dispatch

Learning Objective of the Module

- Determine job requirements of a pre-treatment operation
- Understand Pre-treatment processes
- Set up, load, operate and monitor pre-treatment machines and equipment's
- Performing doffing the product and dispatch

Module Instruction

For using the modules effectively, trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the "LAP test" given at the end of each unit and

Unit One: Requirements for a pre-treatment Operation

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

→ Standard operating procedures (SOPs)

→ Work health and safety (WHS)

5. Read the identified reference book for Examples and exercise

→ Appropriate personal protective equipment (PPE)

→ Job requirements

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

☺ Recognize the standard operating procedures of a job requirement

☺ Undertaking work healthy and safety

☺ Taking the measures of a risk reduction

☺ Interpreting the requirements for a job

1.1. Standard operating procedures (SOPs)

For processes involving hazardous substances, hot liquids, pressurized equipment, and any other processes that may incur risks to safety and health, hazard information and risk control measures should be stated clearly in the respective standard operating procedures and made known to the employees concerned.

a) PPE - wear personal protective materials such as over coat, glove, eye glass
b) Safe material handling – Safe material handling is the job done by every worker in an industry from unloading raw materials , dispatching the finished product and Materials handled between operations in every department or plant of the company.
c) Hazard control measures – are systems that increases awareness are methods that help the worker to detect if a hazard is present. Examples of these hazard controls include warning systems, visual or audible alarms, warning signs, or other indicators that alert the worker to a situation.
d) Workplace Housekeeping - Workplace housekeeping may be defined as activities undertaken to create or maintain an orderly, clean, tidy and safe working environment. Effective housekeeping can eliminate many workplace hazards and help get work done safely and properly. The following measures should be taken for conducting effective housekeeping in the work place.

→ Containers - use robust containers with a closable lid for storage. However, repeated removal and replacement of container lids and opening and closing of bags can also generate more dust. Plan to dispose of containers safely. Bags especially can cause problems and are best placed into disposal sacks at the workstation. Also plan how you will deal with damaged containers and how to dispose of unwanted dyes.

→ Areas where dyes are handled should be easy to clean, with walls and floors that are sound and smooth. Rounded corners are easier to clean. Shelving and workbenches should be easy to clean too or else covered with impervious, disposable covering. They should have a lip to retain spills.

→ Cleaning and dealing with spillages - dry vacuum cleaning, using a piped system or a type H industrial vacuum cleaner, is best for larger dry spillages and most cleaning tasks. Wet vacuuming or other wet cleaning methods may be appropriate in some situations or for smaller spillages. Don't use brushes or brooms or compressed air, as these will simply spread the dust into the air.

→ Ergonomic arrangements of workplace

→ Reporting accidents and incidents

1.2. Work health and safety (WHS)

OHS Practices - Occupational health and safety is one of the most important aspects of human concern. It aims an adaptation of working environment to workers for the promotion and maintenance of the highest degree of physical, mental and social well being of workers in all occupations.

Each workplace should have safe operating procedures, particularly where a hazard exists. Your workplace will have specific work instructions related to safe operating procedures for issues that apply to that workplace.

Some detailed examples include:

Underground services if you are digging a trench, or excavation you need to know what services are below, there could be power, water, gas, sewer, telecommunications, storm water, etc. Each of these items have specified distances that they are located underground, and at the time of installation they were probably correct.

Over the years however soil is sometimes added or taken away and it is not uncommon to locate some services just below the surface. Within each state there are authorities who can come out and identify any underground services. If these authorities are not consulted, you risk personal harm and possibly huge expense if you damage a service.

Overhead services Overhead power lines are a hazard that is easily forgotten about. If you operate a machine that can go anywhere near a power line, then you need to know the recommended safe working distance. The recommended safe working distance varies from state to state, so you should check with your state OHS authority.

1.2.1. General Safe Operating Rules

Regardless of the particular risk reduction measures selected for a particular machine, there are some general safe operating rules that must be observed.

- Restrict access to shops and individual pieces of equipment/machines to authorized operators.
- Avoid working alone in the area so that someone is available to provide or summon assistance in the event of an emergency.
- Read and adhere to the manufacturer's operating instructions and warnings.

- Receive training in proper operation and demonstrate competency to an experienced and authorized operator for each type of task to be conducted before operating independently.
- Know the emergency stop/shutdown procedures for the specific machine operated.

Inspect machines/equipment prior to each operating shift to ensure that:

- → Points of operation and surrounding areas are clean of debris and other hazards.
- → Shields and guards are in place and controls and interlocks or other safety devices are accessible and operating properly (pay attention to the point of operation, as well as the area behind, to the side, and above the machine).
- → Machine components are in good working condition (do not use damaged equipment).
- → Labels and warnings are present and legible.

- Inspect ancillary hazard control devices for proper operation, such as dust collectors used with wood working equipment, etc.
- Do not operate equipment that is damaged or that has missing/defective guards or shields and promptly tag such equipment as “Out-of-Service” and notify the appropriate authority.
- Follow the manufacturer’s recommendations for routine cleaning and preventative maintenance. Do not use compressed air for cleaning of debris.
- Do not attempt to override or defeat safety features. Guards and shields must be in place during normal operation.

1.2.2. Hazard identification and control

Hazard identification is part of the process used to evaluate if any particular situation, item, thing, etc. may have the potential to cause harm. The term often used to describe the full process is risk assessment.

Identify hazards and risk factors that have the potential to cause harm (hazard identification).

Analyze and evaluate the risk associated with that hazard (risk analysis, and risk evaluation).

Determine appropriate ways to eliminate the hazard, or control the risk when the hazard cannot be eliminated (risk control).

Overall, the goal of hazard identification is to find and record possible hazards that may be present in your workplace. It may help to work as a team and include both people familiar with the work area, as well as people who are not – this way you have both the experienced and fresh eye to conduct the inspection.

When should hazard identification be done?

Hazard identification can be done:

- During design and implementation
    - Designing a new process or procedure
    - Purchasing and installing new machinery
- Before tasks are done
    - Checking equipment or following processes
    - Reviewing surroundings before each shift
- While tasks are being done
    - Be aware of changes, abnormal conditions, or sudden emissions
- During inspections
    - Formal, informal, supervisor, health and safety committee
- After incidents
    - Near misses or minor events
    - Injuries

To be sure that all hazards are found:

- Look at all aspects of the work and include non-routine activities such as maintenance, repair, or cleaning.
- Look at the physical work environment, equipment, materials, products, etc. that are used.
- Include how the tasks are done.
- Look at injury and incident records.
- Talk to the workers: they know their job and its hazards best.
- Include all shifts, and people who work off site either at home, on other job sites, drivers, with clients, etc.
- Look at the way the work is organized or done (include experience of people doing the work, systems being used, etc).
- Look at foreseeable unusual conditions (for example: possible impact on hazard control procedures that may be unavailable in an emergency situation, power outage, etc.).
- Determine whether a product, machine or equipment can be intentionally or unintentionally changed (e.g., a safety guard that could be removed).
- Review all of the phases of the lifecycle.
- Examine risks to visitors or the public.

- Consider the groups of people that may have a different level of risk such as young or inexperienced workers, persons with disabilities, or new or expectant mothers.

What types of hazards are there?

A common way to classify hazards is by category:

- biological – bacteria, viruses, insects, plants, birds, animals, and humans, etc.,
- chemical – depends on the physical, chemical and toxic properties of the chemical,
- ergonomic – repetitive movements, improper set up of workstation, etc.,
- physical – radiation, magnetic fields, temperature extremes, pressure extremes (high pressure or vacuum), noise, etc.,
- psychosocial – stress, violence, etc.,
- Safety – slipping/tripping hazards, inappropriate machine guarding, equipment malfunctions or breakdowns.

1.2.3. Risk Assessment and Implementation

Risk assessment is a systematic process of identifying hazards and evaluating any associated risks within a workplace, then implementing reasonable control measures to remove or reduce them.

Risk assessment is a primary management tool in ensuring the health and safety of workers (and others). What many people perhaps are not aware of, however, is that they are actually a legal requirement for employers and certain self-employed people.

When controlling a risk assessment, it is important to clearly define some terms:

→ An **accident** is an unplanned event that results in loss.

→ A **hazard** is something that has the potential to cause harm.

→ A **risk** is the likelihood and the severity of a negative occurrence (injury, ill-health, damage, loss) resulting from a hazard.

1.2.4. Different Types of Risk Assessment

The types of risk assessment required within any workplace should be proportionate and relevant to the operational activities being undertaken. In many industries, there are specific legislative requirements that apply.

Some of the common types of risk assessments include:

Fire risk assessment: fire safety management procedures are required to be established in all workplaces including a suitable and sufficient fire risk assessment.

Manual handling risk assessment: should be conducted in any workplace where employees may be at risk from injury and/or ill-health through the need to lift, carry, and move loads.

Display Screen Equipment (DSE) risk assessment – are required to be completed in workplaces where employees (and others) are using computers, laptops, etc.

1.2.5. Risk Implementation

The process of putting a strategic plan of managing identified threats and exploiting opportunities in to action is called the implementation of the risk management plan. Such a process may take many forms and this depends on the business culture of the performing organization, history of previous efforts, available resources, number of individual involved in the project, and other factors.

In addition the implementation can be done in various ways. For instance, in a marketing campaign project a number of implementation approaches for the risk management plan are available to develop or maintain a competitive advantage. They include such methods as creating barriers to market entry, establishing competitive pricing, and damping, using new unique technology, innovation, adjusting or organizing personnel management etc. each of these methods implies a very different set of tools for implementation. However, no matter what methods and tools you going choose to implement process. These are:

Resource Acquisition: before you can start implementing your risk management plan you need to be certain that correct quantity of required resources is available and ready for use. You can obtain the resource in a range of way, for example by purchasing with credit, renting/leasing, sub-contracting, shared arrangements, partnership etc.

Resource flow: it is important to manage the flow of resources. The key idea behind this is to ensure that the resources are available at appropriate levels in needed placed required time. Hence the flow of resources is available at appropriate levels in needed placed at required time. Hence the flow of resources should be managed in terms of quantity, location and time. if the use of resources in optimized then the risk management process is likely to generate optimum output.

Resource coordination: when the resources are acquired and allocated in a proper way now you need to coordinate the use of resources throughout the implementation process. The coordination requires you to develop detailed operational plans and conduct day-to-day oversight of the operations.

All the resources available for performing your risk management initiative will be the driving force that lets you make decisions on the scope of the implementation process. Then the way you

acquire, use and coordinate the resources within the process determines the future of your project effort. Your resources include people, finances, time, buildings, technology, others.

1.2.6. Risk Reduction Measures

The measures of a risk reduction are applied by using an analysis called Safe job analysis (SJA). It is used to identify hazards and risk-reducing measures for a particular work task or activity. SJA is particularly relevant for work tasks and activities not adequately covered by the operations procedure, as part of a deviation request to an approved procedure and for work involving several work groups or work tasks or activities in the same area. SJA is particularly relevant for work tasks and activities with details not adequately covered by the operations procedure, SJA shall be performed by the actual personnel involved in the tasks or activity.

Risk reducing measures include frequency reducing and consequence reducing activities, and their combinations. The measures may be of a technical, operational, and/or organizational nature. Choosing the types of measures is normally based on a broad evaluation, where risk aspects are considered. Emphasis should be put on an integrated evaluation of the total effects that any risk reducing measures may have on the risk. If alternative measures are proposed, possible coupling between risk reducing measures should be communicated explicitly to the decision-makers. Priority is given to the measures that reduce the frequency for a hazardous situation, when choosing which measures are initiated and developed into an accident event. In order to reduce any consequences, measures should be taken into account for the design of load bearing structures and passive fire protection, etc. Layout arrangements are suitable for the operations and minimize the exposure of personnel to accidental loads.

When selecting risk reducing measures, consideration is given to their reliability and the possibility of documenting and verifying the estimated extent of risk reduction. Consequence reducing measures (especially passive measures such as passive fire protection) will often have a higher reliability than frequency reducing measures, especially for the operating conditions.

The possibility of implementing certain risk reducing measures is dependent on factors such as available technology, the current phase in the activity, and the results of cost–benefit analysis. The choice of risk reducing measures can therefore be explained in relation to such aspects.

1.3. Appropriate personal protective equipment (PPE)

Personal Protective Equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workspace injuries and illness. These injuries and illness may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Some of the types of PPE include the following:

Eye and Face Protection

Employees can be exposed to a large number of hazards that pose danger to their eyes and face. It is required from employers to ensure that employees have appropriate eye or face protection if they are exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, potentially infected material or potentially harmful light radiation.

Head Protection

Protecting employees from potential head injuries is a key element of any safety program. Employers must ensure that their employees wear head protection if any of the following apply:

- ✓ Objects might fall from above and strike them on the head;
- ✓ They might bump their heads against fixed objects, such as exposed pipes or beams; or
- ✓ There is a possibility of accidental head contact with electrical hazards.

Foot and Leg Protection

Employees who face possible foot or leg injuries from falling or rolling objects or from crushing or penetrating materials should wear protective footwear. Examples of situations in which an employee should wear foot and/or leg protection include:

- ✓ When heavy objects such as barrels or tools might roll onto or fall on the employee's feet;
- ✓ Working with sharp objects such as nails or spikes that could pierce the soles or uppers of ordinary shoes;
- ✓ Exposure to molten metal that might splash on feet or legs;

Hand and Arm Protection

If a workplace hazard assessment reveals that employees face potential injury to hands and arms that cannot be eliminated through engineering and work practice controls, employers must ensure that employees wear appropriate protection.

1.4. Job requirements

Job requirements are “must haves” that an employer is looking for in a candidate for a certain job position. Or Job Requirements are the skills, experience, and attributes an employer expects to find in a candidate who is hired for a position. The employer deems those qualifications as essential to satisfactory performance in that job and these requirements help set expectations for both employers and potential employees, and help ensure that qualified people apply for positions. Job requirements aren’t just a list of specific qualifications, education, knowledge and skills needed for a particular position.

These qualifications include: Work experience, Skills (soft skills and/or technical skills), Specific knowledge, Education level and type, Professional licenses, accreditations and certifications, Personal qualities and attributes, Languages, Physical abilities. Employers may choose candidates who excel in certain key areas but are lacking in others. When creating a job listing, employers imagine an ideal candidate, but they may never find someone who meets all of their requirements.

Self-Check 1	**True/False, Multiple Choice & Blank Test**

Name _____ ***I.D*** _____ ***Date*** _____

Directions: Answer all the questions listed below.

Test I: True/False questions

1. Hazard control measures may be defined as activities undertaken to create or maintain an orderly, clean, tidy and safe working environment.
2. Fire safety management procedures are not required to be established in all workplaces including a suitable and sufficient fire risk assessment.
3. Job requirements aren't just a list of specific qualifications, education, knowledge and skills needed for a particular position.
4. Acquired and Allocated in a proper way now you need to coordinate the use of resources throughout the implementation process.
5. Manual handling risk assessment focuses where employees may be at risk from injury and/or ill-health through the need to lift, carry, and move loads.

Test II: Multiple Choice Questions.

1. The measures of risk reducing measures includes frequency reducing and consequence reducing activities, and their combinations are a) technical b) frequency c) normal d) random
2. _____ is equipment worn to minimize exposure to hazards that cause serious workspace injuries and illness.

   A. Work place B. PPE C. Exposure D. Protection.
3. Which of the following are not the categories of injuries and illness which may be resulted in the work place.

   A. Chemical B. Radiological C. Physical D. Hazard
4. The uses of wearing foot and leg protection is used to not:
   A. To protect from chemical splice to the feet
   B. To protect from falling of heavy objects
   C. To expose the foot for damage
   D. To protect from penetrating of sharp objects
5. _____ are the skills, experience, and attributes an employer expects to find in a candidate who is hired for a position.

A. Job requirement B. Skill acquisition C. Performance D. Operator

6. The qualifications in the job requirements does not include
   A. Work experience
   B. Skills (soft skills and/or technical skills)
   C. Specific knowledge
   D. Education level and type e) profit

Test III: Short Answer Questions.

1. The process of putting a strategic plan of managing identified threats and exploiting opportunities in to action is called _____.
2. _____ is a systematic process of identifying hazards and evaluating any associated risks within a workplace.
3. The measures of a risk reduction are applied by using an analysis called _____.
4. A _____ is something that has the potential to cause harm.
5. _____ are "must haves" that an employer is looking for in a candidate for a certain job position.
6. A _____ is the likelihood and the severity of a negative occurrence (injury, ill-health, damage, loss) resulting from a hazard.

Unit Two: Pre-treatment processes

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- → Meaning and processes of Pretreatment technologies
- → Types and properties of pretreatment chemicals
- → Interaction of Chemicals with textiles
- → Properties & functions of Chemical & auxiliaries

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- ☺ Understanding Meaning and processes of Pretreatment technologies
- ☺ Understanding Types and properties of pretreatment chemicals
- ☺ Understanding Interaction of Chemicals with textiles
- ☺ Identifying Properties & functions of Chemical & auxiliaries

2.1. Meaning and processes of Pretreatment technologies

Pretreatment is a heart of processing of textile. In Pretreatment, all these impurities are removed and fabric is brought to a stage where it is more absorbent and white and can be easily processed further. The process which is done to make the textile materials suitable for dyeing and printing. Such as singeing, desizing, scouring, bleaching etc.

Flow chart of pretreatment of cotton fabric:

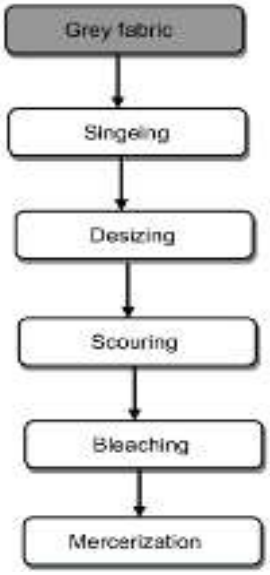

Figure 2.1: Flow Chart of Pre-treatment Process

All the processes of this stream are carried out in an aqueous state or aqueous medium. The main processes of this section include:

• Shearing/ Cropping/ & Singeing
• Desizing
• Scouring
• Bleaching
• Mercerizing

2.1.1. Shearing/cropping/ & Singeing

Shearing/Cropping

- ✓ Shearing is the process of cutting projecting fibers and yarns to give smooth and clean appearance by rising knives and blades.
- ✓ In shearing, the fibres are cut in an angular manner on the surface of the fabric itself, resulting in a soft feel Singeing and shearing are almost the same in effect.

- ✓ In singeing the fibres in the interlacement of the fabric are burnt by flames whereas in shearing the fibres are cut in an angular manner on the surface of the fabric itself, resulting in a soft feel.

Singeing

Singeing is a mechanical process by which hairy, loose fibers are removed from the surface of the textile material either by heating or burning to make the material smoother and lustrous.

- ➢ The process of singeing is carried out for the purpose of removing the loose hairy fibers protruding from the surface of the cloth, thereby giving it a smooth, even and clean looking face.
- ➢ Singeing is an essential process for the goods or textile material which will be subjected to mercerizing, dyeing and printing to obtain best results from these processes.
- ➢ The fabric passes over brushes to raise the fibers, then passes over a plate heated by gas flames.
- ➢ When done to fabrics containing cotton, this results in increased wetability, better dyeing characteristics, improved reflection, no "frosty" appearance, a smoother surface, better clarity in printing, improved visibility of the fabric structure, less pilling and decreased contamination through removal of fluff and lint.

Figure 2.2: Singing machine with its process

Singeing machines can be of three types:

- ➢ **Gas Singeing** is widely used in the textile industry. In gas singeing, a flame comes into direct contact to the fabric and burn the protruding fiber. Here, flame height and fabric speed is the main concern to minimize the fabric damage. Singeing is performed only in the woven fabric. But in case of knit fabric, similar process of singeing is known as biopolishing where enzyme is used to remove the protruding fibres.
- ➢ **Roller Singeing –** in this method, instead of passing the cloth over fixed plates, it is passed over a hollow cylinder of copper or cast iron which is heated internally and is a modification

of the plate singeing machine. The cylinder rotates slowly and so presents a fresh hot surface to the oncoming fabric.

- **Plate Singeing –** in the process of plate singeing, the plates are heated with the help of certain fuels (combination of air and gas), when heated, it turns reddish. Then the fabric is passed over two heated curved plates at a fixed speed (135 – 225 m/min). The thickness of these plates is 1 – 2 inches.

2.1.2. Desizing

Desizing is a typical process step in pre-treatment of woven fabrics made of cotton and cotton blends but also necessary for all grey synthetic materials containing sizes. The sizing agents on the warp yarns, applied in weaving mills for better weaving efficiency, have to be removed before further processing in textile finishing.

Desizing is the process of removing sizing materials from the fabric, which is applied in order to increase the strength of the yarn which can withstand with the friction of loom. Fabric which has not been desized is very stiff and causes difficulty in its treatment with different solution in subsequent processes. After singeing operation the sizing material is removed by making it water-soluble and washing it with warm water.

Major desizing process

1. Rot steeping - Fabric is stored in warm water at 40-60oC overnight. It removes the starch and water soluble impurities with natural reaction.

   Drawback:

   It is a time consuming process that one cannot certain that in the given duration size will remove completely.

2. Oxidative Desizing - Starch and other added impurities are hydrolyzed through oxidation process followed by washing process.

Oxidizing agents: Sodium Hypochlorite: 2.0-5.0 gm/lit. at room temperature at pH 7.0, Hydrogen peroxide:3.0-6.0 gm/lit of H2O2 and 7.0-15.0 gm/lit Sodium Hydroxide, 40oC for 12-16 hours.

Drawback:

- Time consuming Process
- Sometime bleaching effect also obtain (If not require in the end product)

3. Acid Steeping

Acid hydrolysis lowers the molecular weight and reduce starch to glucose. Fabric is treated with Sulphuric Acid (0.5% to 1.0 %) at 40°C. It also remove the starch and water soluble impurities with natural reaction.

Drawback:

- Tendering of cellulosic fibre if precautions are not taken
- If the acid remain in the fabric, whole lot may get seriously damage or tendered

4. Enzyme Desizing

Enzyme solution in water with 0.5% to 2.0% on weight of fabric enzyme. It requires a quantity of Common salt is also required at a Neutral pH. Other method fabric is run continuously in machine having enzyme solution. Enzymes are high molecular weight protein biocatalyst that are very specific in their action. Enzymes are named after the compound they break down, for example: Amylase breaks down amylose and amylopectin, Maltase breaks down maltose and Cellulase breaks down cellulose. For desizing starch, amylase and maltase are used.

Figure 2.3: desizing process with its process

2.1.3. Scouring (kier boiling)

Scouring is a chemical washing process carried out on cotton fabric to remove natural wax and non-fibrous impurities (e.g. the remains of seed fragments) from the fibers and any added soiling or dirt. Scouring is usually carried in iron vessels called kiers. The fabric is boiled in an alkali, which forms a soap with free fatty acids (saponification). A kier is usually enclosed, so the solution of sodium hydroxide can be boiled under pressure, excluding oxygen which would degrade the cellulose in the fiber. If the appropriate reagents are used, scouring will also remove size from the fabric although desizing often precedes scouring and is considered to be a separate process known as fabric preparation.

Preparation and scouring are prerequisites to most of the other finishing processes. At this stage even the most naturally white cotton fibers are yellowish, and bleaching, the next process, is required.

Figure 2.4: Scouring process with its process

The three main processes involved in the scouring are:

→ Saponification

→ Emulsification

→ Detergency

The main chemical reagent used in the cotton scouring is sodium hydroxide which converts saponifiable fats and oils into soaps, dissolves mineral matter and converts pectose and pectin into their soluble salts. Another scouring chemical is detergent which is an emulsifying agent and removes dust and dirt particles from the fabric. Since damage can be caused to the cotton substrate by sodium hydroxide. Due to this, and in order to reduce alkali content in the effluent, Bio-scouring is introduced in the scouring process in which biological agent is used, such as an enzyme.

2.1.4. Bleaching

Bleaching improves whiteness by removing natural coloration and remaining trace impurities cotton; the degree of bleaching necessary is determined by the required whiteness and from the absorbency. Cotton being a vegetable fiber will be bleached using an oxidizing agent, such as dilute sodium hypochlorite or dilute hydrogen peroxide. If the fabric is to be dyed a deep shade, then lower levels of bleaching are acceptable. However, for white bed sheets and medical applications, the highest levels of whiteness and absorbency are essential.

Figure 2.5: Bleaching with its process

Reductive bleaching is also carried out, using sodium hydrosulphite. Fibers like polyamide, polyacrylics and polyacetates can be bleached using reductive bleaching technology. After scouring and bleaching, optical brightening agents (OBA), are applied to make the textile material appear more white. These OBAs are available in different tints such as blue, violet and red.

2.1.5. Mercerizing

Mercerization is a treatment for cotton fabric and thread that gives fabric or yarns a lustrous appearance and strengthens them. The process is applied to cellulosic materials like cotton or hemp. A further possibility is mercerizing during which the fabric is treated with sodium hydroxide solution to cause swelling of the fibres. This results in improved lustre, strength and dye affinity. Cotton is mercerized under tension, and all alkali must be washed out before the tension is released or shrinkage will take place. Mercerizing can take place directly on grey cloth, or after bleaching.

2.1.6. Washing/ Drying

The purpose of washing

- Pretreatment chemical processes of textiles involve the removal of textile fiber impurities.
- During pretreatment process the impurities are converted in to their simple or soluble state.

Washing process has three phases

→ Loosing of impurities

→ Transfer of impurities

→ Removal impurities

Washing equipment

→ Batch wise/discontinuous/machinery; e.g. jigger, winch etc.

→ Rope washing machine

2.1.7. Heat Setting

→ Heat setting (also called thermo fixation) is carried out on fabrics made of man-made fibers or blends of them with natural fibres to relax tensions in the textile resp.

→ Fibers due to upstream fibre /yarn/fabric processing and to improve the dimensional stability of the textiles.

→ Heat setting is carried out continuously in a stenter at temperatures between 170 – 220 °C.

→ Heat setting can be done on grey fabrics as a pre-treatment step, as an intermediate step after dyeing or as a last finishing (often in combination with application of finishing auxiliaries).

2.1.8. Carbonizing and degumming

a) Carbonization

→ Raw wool may also be contaminated with vegetable matter which may be primarily cellulosic in nature, consisting of seeds, burrs, grass etc.

→ The wools destined to be processed by worsted route may have substantial amount of vegetable matter removed during carding, gilling and combing.

→ However wools with high content of vegetable matter may need to be treated chemically for its removal in the loose stock stage itself.

→ The most commonly employed method for removal of vegetable matter from wool is treatment with mineral acids, especially sulphuric acid.

→ The treatment is based on the premise that the stability of wool to hot mineral acids is higher than that of cellulose.

→ The treatment with mineral acids turns the cellulose into brittle carbonaceous mass which can be removed by crushing it into a powder.

Sequences:

Acidification → Drying/Baking → Crushing → Dusting → Neutralization

→ Dusted & Neutralized with sodium bicarbonate.

→ Bleaching with acidic hydrogen peroxide to minimize yellowing caused by carbonization

b) Silk degumming

→ The main objective of silk degumming process is to impart soft handle and lustre to silk by removing sericin, any impurities picked up during reeling throwing etc.

→ Some natural wax, coloring matter and minerals may also be removed during degumming.

→ Since sericin forms bulk of the gum or the outer protective coat in a silk filament, which also happens to be a protein, the process mainly consists of cleavage of peptide bonds of serecin, either by hydrolytic or other methods, and its subsequent removal from fibroin by solubilization or dispersion in water.

Following are the main Degumming Processes:

→ Extraction with water.

→ Boil-off in soap.

→ Degumming with alkalis.

→ Degumming with acids.

→ Degumming with enzymes.

→ Degumming with organic amines.

2.2. Types and properties of pretreatment chemicals

2.2.1. Desizing Process

The lists of chemicals which are used for oxidative desizng operation are as follows:

Table 2.1: Oxidative Desizng Operation

Chemicals used	***Concentration (%o.w.f)***	**MLR** : 1:20 **PH** = 8-9 **Temperature** = 90°c **Time** = 10 - 15 min.
		Use
Hydrogen peroxide (35%)	0.2 – 0.35	A desizing agent which is used as a main chemical ingredient
Caustic Soda (100%)	2 - 6	Used for removing the size matter
Sodium silicate	0 - 1	Used for buffering the operation
Magnesium Sulphate	0.005	Used for activating the desizing operation
DTPA* (40%solutin)	0.2	Used for water softening for precipitating heavy metal ions
Wetting Agent	0.2 – 0.5	Used for wetting and detergency

DTPA- Diethylenetriamine pentaacetic acid

The lists of chemicals which are used for enzymatic desizng operation are as follows:

Table 2.2: Enzymatic Desizng Operation

Main Chemicals	***Concentration (gpl)***	**MLR** : 1:20 **PH** = 6-7 **Temperature** = 70-80°c **Time** = 60 min.
		Use
Enzyme biolase	2.5-10	The main desizing agent which removes the size matters
Sodium chloride	5	Are used for stabilizing the PH media of the desizing solution.
Non ionic wetting agent	1.5	Used to enhance the temperature stability of enzymes.

2.2.2. Scouring Process

The lists of chemicals which are used for scouring operation are as follows:

Table 2.3: Scouring Operation

Main Chemicals	***Concentration (% o.w.f)***	**MLR** : 1:20 **PH** > 11 - 12 **Temperature** = 95 – 98°c **Time** = 1 – 2 hr. ***Use***
Caustic soda (100%)	3 – 4	The main desizing agent which removes added and natural impurities.
Wetting agent	1	Are used for reducing surface tension & minimize interfacial tension between the desizing agent and textile substrate.
Water	0.1 – 0.2	The media for operating effective work.

2.2.3. Bleaching Process

The lists of chemicals which are used for peroxide bleaching operation are as follows:

Table 2.4: Peroxide Bleaching Operation

Chemicals used	***Concentration (% o.w.f)***	**MLR**: 1:20 **Temperature** = 90 - 100°c **PH** = 10.5 - 11 **Time** = 60 – 90 min ***Use***
Hydrogen peroxide (35%)	3 – 5	The bleaching agent which is termed as the main reagent
Caustic soda (100%)	03 - 0.8	Used for boosting the main bleaching agent, peroxide
Sodium carbonate	0.6 – 0.1	Used for boosting the chemical reaction
Sodium silicate	2 – 3	Used as a buffering agent for controlling the PH of the solution
Magnesium Sulphate	0.5	
Wetting agent + sequestering agent	0.1 – 0.5	Used for wetting, detergency and precipitation of heavy metal ions.

2.2.4. Combined Pretreatment Process

The lists of chemicals which are used for combined pretreatment operation are as follows:

Table 2.5: Combined Pretreatment Operation

Main Chemicals	***Concentration (% p.w.f)***	**MLR:** 1:25 **Temperature** = 80-90^{0}c **Time** = 1 - 1:30 hours **PH** = 11 ***Use***
H_2O_2 (35%)	5	The bleaching agent which de-colors the natural impurities
NaOH	0.9	The main scouring agent which removes added and natural impurities.
Sodium silicate	2	Used as a buffering agent for effective pretreatment media
Non-ionic wetting agent	0.1	For wetting and detergency
Sodium diphersulphate	0.3	Used for boosting the main pretreatment chemicals

2.2.5. Mercerization Process

The lists of chemicals which are used for mercerizing operation are as follows:

Table 2.6: mercerizing operation

Chemicals used	***Amount***	***MLR – 1:20*** ***Temperature – RT*** ***Time – 2 min*** ***Use***
Concentration of NaOH	300g/1 (g/l)	Main alkali for the mercerization process
Wetting agent	5 (g/1)	Used for wetting and detergency
Acetic acid	3 (% o.w.f)	For keeping the fabric from excessive severe

2.2.6. Washing Process

Washing is a process by which various types of impurities are removed through water treatment. Water treatment helps in removing dust and hydrolysis product of sizing materials. Washing plays a vital role in removing size chemicals, eliminating stains and increasing absorbency.

The lists of chemicals which are used for mercerizing operation are as follows:

Table 2.7: Washing Process

Chemicals used	***Amount***	***MLR*** ***Temperature – (80 – 90)^{o}C*** ***Time – 15 min***
		Use
Hot water	--	Used as a playing media
Detergent	2 – 3 g/kg	Used for impurity removal, wetting and detergency
Acetic acid	2 – 3 g/l	For keeping the fabric from being alkaline & maintaining at a neutral PH

2.3. Interaction of Chemicals with textiles

2.3.1. Desizing Process

In Enzyme Desizing (most commonly used desizing type):

→ Enzyme desizing is the most widely practiced method of desizing starch as they are high molecular weight protein biocatalyst that are very specific in their action. Enzymes are named after the compound they break down, for example: Amylase breaks down amylose and amylopectin, Maltase breaks down maltose and Cellulase breaks down cellulose. For desizing starch, amylase and maltase are used.

2.3.2. Scouring Process

In order to quickly and effectively bring the chemicals to the textile material, i.e. to improve their wet ability and to ensure that the fibrous impurities will be removed as far as possible, it is necessary to add surfactants with good wetting and washing/ emulsifying properties. A surfactant of optimal versatility to be used for preparation, and in particular for the scouring and bleaching processes, ought to meet the following requirements:

• It should have an excellent wetting ability within a wide temperature range

• It should permit a good washing effect and have a high emulsifying power for natural fats, waxes and oils

• It should be resistant to oxidants and reducing agents

• It should be resistant to water-hardening substances

• It should be highly stable to alkalinity

• It should be biodegradable and non-toxic

2.3.3. Bleaching Process

During bleaching the interaction of bleaching chemicals with the textile fabric is assessed as follows:

Various methods of bleach clean-up are employed in the textile industry. These involve - repetitive washing, catalytic decomposition, reductive neutralization and enzymatic killing.

1. Washing with fresh water was the popular method employed in the past and still adopted in some areas for complete removal | depletion of the left over oxidizing agent. Though this is a simple process it:

- Requires high amount of water for repeated washing
- Increases energy consumption for heating water which is unprofitable
- Lengthens processing time due to draining and refilling of the machine

2. Catalytic decomposition involves use of salts of selected heavy metal ions which under controlled temp and alkaline pH conditions rapidly activate rate of decomposition of residual hydrogen peroxide and thereby destroying it completely. Though the process is simple, fast and cost effective, the disadvantage is if the residual peroxide content is high and the process is not controlled adequately it may result in degradation of cellulose causing breakages in yarn and pin holes in fabric.

3. Reductive neutralization is based on use of inorganic salt based reducing agent like RUCORIT INPK which works at the equal concentration of the residual peroxide and effectively cleans it up. The specific advantage of this product is:

- Cost economic
- Ready to use, easy to handle, pumpable liquid formulation
- Stable to hard water, robust under process conditions
- Water and energy conserving application process
- Enhances whiteness index in case of full bleach process

- Effectively removes chloramine after chlorine bleach process
- Simple application process under high temp alkaline conditions
- Develops alkaline reductive atmosphere in dye bath making it highly suited for material to be dyed with Vat and Sulphur dyes
- Being Inorganic does not increase COD and BOD of effluent

4. Enzymatic Killing - this is the latest and advanced method of bleach clean-up specifically developed for neutralization of residual hydrogen peroxide based oxidizing agent in post bleaching process. Generally, the enzyme used here is "Catalase" which belongs to oxido-redutase class. This enzyme catalyses the decomposition of hydrogen peroxide to oxygen according to:

Catalase

2H2O2 2H2O + O2

The Enzyme is a bio catalyst produced by fermentation of microorganisms, acts very specifically on hydrogen peroxide and increases reaction speed by lowering the activating energy without any harmful side effects. Enzymes present a more convenient alternative because they are easier and quicker to use.

2.3.4. Mercerization Process

Physico-chemical changes during mercerization:

Under the action of concentrated alkaline solutions chemical, physico-chemical and structural modifications of cellulose take place. Native cellulose (Cellulose I) forms alkali cellulose I with concentrated sodium hydroxide. On washing and neutralisation cellulose II is formed.

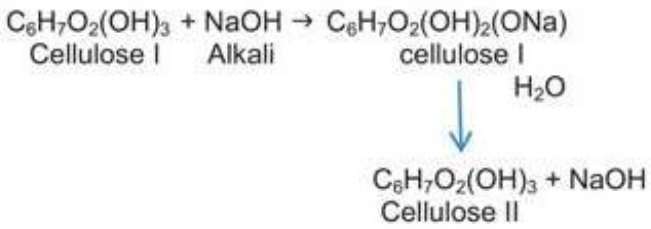

Figure 2.2: Structure of mercerized cotton

As a result of the penetration of the alkali into the lattice, internal hydrogen bonds are broken and in Cellulose II the number of available hydroxyl groups (-OH) is increased by around 25%. The treatment with alkali and subsequent washing may be performed so that the fabric or yarn may either freely contract or they may be held under tension. In both cases the mercerized cotton has

an increased affinity for both reactive and direct cotton dyes, water and an increased strength. Cotton yarn or fabric mercerized without tension contracts, but if held under tension it retains its original dimensions and the lustre is increased. Major changes during Mercerization can be divided into three levels.

Figure 2.3: comparison of mercerized with un-mercerized cotton on dyed fabric

At Fibre level, Swelling; Cross sectional morphology changes from beam shape to round shape and Shrinkage occur along with longitudinal direction. At Molecular level, it will have Hydrogen bond readjustment, Orientation (parallelization) of molecular chains in amorphous region along the direction of fibre length and Orientation of the crystallinity in the direction of the fibre length. On the other hand it facilitates Chemical Changes like, Increased rate of reaction on hydrolysis and oxidation; Liberation of heat during the caustic treatment (heat of sorption and heat of reaction; Increase in the alkali absorption and Increase in the absorption of iodine.

2.4. Properties & functions of Chemical & auxiliaries

2.4.1. Desizing Process

Enzymatic desizing – is the classical dessizing process of degrading starch size on cotton fabrics using enzymes. Enzymes are complex organic, soluble bio-catalysts, formed by living organisms that catalyse chemical reaction in biological process. Enzymes are quite specific in their action on a particular substance. A small quantity of enzyme is able to decompose a large 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.

Amylase are the enzymes that hydrolyses and reduce the molecular weight of amylase and amylopectin molecules in starch, rendering in 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 susrfactants.

Oxidative desizing – in oxidative desizing, the risk of damage to the cellulose fiber very high, and its use for desizing is increasingly rare. Oxidative desizing uses potassium or Sodium Persulfate Bromite as an oxidizing agent.

Acid Desizing – cold solutions of sulphuric or hydrochloric acids are used to hydrolyse the starch, however, this has th disadvantage of also affecting the cellulose fiber in cotton.

Fabrics containing water-soluble sizes can be desized by washaing 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 residues.

2.4.2. Scouring Process

Scouring is a preparation process to prevent problems at the next process such as dyeing or finishing by eliminating hydrophobic impurities on greige fabric without deteriorating the fabric itself. Scouring agent is required to eliminate the impurities effectively such as sizing agent or lubricating agent, stains from weaving process and abrasion stains which come from greige woven or knitted fabric. The required property of scouring agent varies depending on materials, fabric structure, stains and applications. The primary impurities in which the natural substances which fiber originally has: Pectic Substances, cotton wax, fatty substances, protein substances, inorganic substances (metal), dye composition. The secondary impurities in which adhered substance in process are spinning oil, knitting oil, needle oil, sizing agent, waxing agent, rust, dust, etc.

Mechanism of action

The surfactant, the main component of the scouring agent, is composed of hydrophobic and lipophilic groups and forms surfactants micelles in the bath. The lipophillic group of the surfactant adsorbs to the oil attached to the fiber and exerts an emulsifying function by being incorporated in to micelles. In addition, due to the function of the hydrophilic group, the oil-incorporated micelles are dispersed stably in the bath to remove oil stains on the fibers.

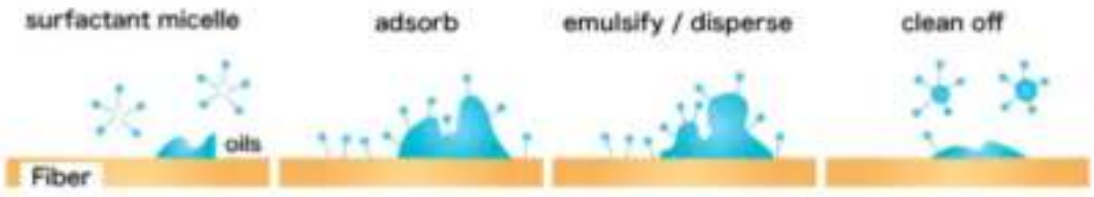

Figure 2.4: Scouring effect on Cotton Textiles

2.4.3. Bleaching Process

Bleaching solid or liquid chemicals used to whiten or remove the natural colour of fiber, yarns, or fabrics. In textile finishing, the bleaching process is used to produce white cloth, to prepare fabrics for other finishes, or to remove discoloration that has occurred in other processes. Bleaching is also used as a disinfectant because of its microbal properties.

2.4.2. Mercerization Process

Mercerization may be carried out on grey fabrics or after scouring/bleaching. If mercerization is carried out in the grey state; complete removal of alkali is not necessary during washing treatment as the residual alkali in the other treated fabrics. Cellulose under goes chemical, physico- chemical and structural modifications on treatment with caustic soda of the mercerizing strength. Chemical reactions lead to the formation of the alkali-cellulose ($C_6H_9O_4$-ON_a). The Changes in the Properties of Cellulose Due to Mercerization are:

Swelling and Shrinkage of Cellulose - Under optimum condition each cotton fiber may be contract early 9% in length and swells nearly 150%. Shrinkage of cotton is greatest on swelling in alkali at 15-18^{0}c and the value decreases with increase in temperature.

Structural modification - Due to swelling of cellulose in caustic soda solution of mercerizing strength, many hydrogen bonds are broken, the plane of molecular chains have been moved apart, molecular structure tend to become de-crystallized, the chains or spaces within the cellulose structure become more, uniform and the chains of glucose residues have been given on slight twist. Because of distortion of polymer network and changes in crystalline structure, the process of mercerization is irreversible.

Gain in Strength - Mercerization, both slack and with tension increase the strength uniformly along the fiber length, but mercerized fiber with tension shows greater gain in strength than that of without tension.

Increased Luster – The flat ribbon structure of un-mercerized cotton resulted less in luster, but in case of mercerized cotton the crossection of the fiber becomes circular and the lumen is practically eliminated. Luster increases, as the tension applied to the fiber during mercerization is increased.

Increased Moisture Absorption - Due to caustic soda penetration many hydrogen bonds are broken and it is estimated the number of available, hydroxyl groups are increased by about 25%. Mercerization thus decreases the amount of crystalline part of fiber or increases the amorphous

content of fiber. Standard cotton has moisture content of about 7%, mercerized cotton with tension has about 9% and that of without tension about 11%.

Increased Dye Adsorption - Mercerized cotton shows increased depth of shade; increased rate of dyeing and the irregularities due to neps and unripe cotton are less prominent.

Increased Reactivity - the reactivity of mercerized cotton is increased by 1.5 times at lower temperature in comparison that of unmercerizing cotton.

Removal of Immature Cotton - In this method, immature (dead) fibers are removed to obtain level dyeing effects on cotton fibers.

Self-Check 2	True/False, Multiple Choice & Blank Test

Name _____ ***I.D*** _____ ***Date*** _____

Directions: Answer all the questions listed below.

Test I: True/False Questions

1. The most commonly employed method for removal of vegetable matter from wool is treatment with mineral acids is called degumming process.
2. The three main processes involved in the scouring are saponification, emulsification & detergency.
3. It is possible to carry out the next treatment operation without performing pretreatment operation.

Test II: Multiple Choice Questions.

1. The reaction which is seen during pretreatment of scouring process is called _____.
   A. Saponification B. Exothermic C. Endothermic D. Reverse
2. During carbonization _____ may also be contaminated with vegetable matter which may be primarily cellulosic in nature, consisting of seeds, burrs, grass etc.
   A. Silk fiber B. Raw wool C. Cotton fiber D. Flax extraction
3. Which type of desizing process requires a quantity of Common salt is also required at a Neutral pH.
   A. Rot steeping B. Acid desizing C. Enzymatic desizing D. Oxidative desizng
4. The universal bleaching agent which is used for achieving an improved white textile is:
   A. Caustic soda B. Common salt C. Hydrogen peroxide D. Hydrochloric acid
5. The main processes of pretreatment section does not include:
   A. scouring B. Bleaching C. Desizing D. Printing
6. _____ is a chemical washing process carried out on cotton fabric to remove natural wax and non-fibrous impurities from the fibers.
   A. Printing B. Washing C. Scouring D. Bleaching

Test III: Short Answer Questions.

Matching

A		B	
_____1.	Desizing	**A.**	Removes waxes and natural oils
_____2.	Mercerization	**B.**	Removes protruding fibers
_____ 3.	Singeing	**C.**	Removes natural coloring matter
_____ 4.	Scouring	**D.**	Removes size matter
_____ 5.	Bleaching	**E.**	Treating by using concentrated caustic soda

Test IV: Short Answer Questions.

1. _____ is a mechanical process by which hairy, loose fibers are removed from the surface of the textile material either by heating or burning.
2. _____ is one of the types of singeing widely used in the textile industry.
3. _____ is one of the types of desizing process abric is stored in warm water at 40-60oC overnight.
4. The purpose of washing in the pretreatment processing operation is the removal of textile fiber impurities.
5. Write down the sequences of carbonization process.

   _____
6. _____ process is aimed to impart soft handle and lustre to silk by removing sericin, any impurities picked up during reeling throwing etc.
7. Mention the main Degumming Processes.

   _____

   _____

   _____

   _____

   _____

   _____

Unit Three: Operation of Pre-treatment machines & equipments

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- → Quality of a textile product
- → Load, start and monitor pretreatment process
- → Pretreatment process & product faults
- → Report the pretreatment operation

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- ☺ Checking the quality of the pre-treated textile product
- ☺ Loading, starting and monitoring pretreatment process
- ☺ Checking pretreatment process product faults
- ☺ Reporting the pretreatment operation

3.1. Quality of a textile product

3.1.1. Quality of desized fabric for scouring Process

Since the main objective of desizing is to remove the sizing materials which are added on the weaving preparatory process, the most important assessment of textile goods is assessment of weight loss computations. For the determination of desizing efficiency, the amount of size on grey fabric and residual size on the desized fabric is determined.

The desizing efficiency is then calculated as follows:

- A desizing efficiency value of 90% is considered to be excellent and that of 80-90% is considered to be
- Satisfactory. Values below 80% indicate poor desizing.
- This test procedure is rather cumbersome for routine work.
- Hence, the amount of size and residual size on grey and desized fabric may be determined by enzyme-
- desize only, using a good quality enzyme.
- Complete size removal may be checked by testing with acidified iodine solution.

$$\% \text{ Desizing efficiency} = \frac{\% \text{ Original size} - \% \text{ Residual size}}{\% \text{ Original size}} \times 100\%$$

3.1.2. Quality of scoured fabric for bleaching Process

Scouring is the pretreatment process by which oil, wax, fat are removed from fabric. So that fabric weight will be reduced slightly (in case of good souring 4%-8%) and absorbency of fabric will be higher for removing of oil, wax, fat etc. Absorbency test are determined by Drop test, Spot test, Immersion test and column test.

Estimation of Scouring Effect

a. Determination of Weight Loss

$$\text{Weight loss } \% = \frac{\text{Weight before scouring} - \text{Weight after scouring}}{\text{Weight before scouring}} \times 100$$

$$= \frac{9.311 - 8.8}{9.311} \times 100$$

$$= 5.48\ \%$$

Standard range of weight loss = 4-8%

So it is (5.48 %) moderate scouring

b. Absorbency Test

- **Immersion Test**

Test: sample of (1 x 1) cm2 size is cut and it is left on water surface. With the help of stop watch, the time of the fabric for immersing is recorded.

The standard time of immersing is 5sec.

Expt. Sample immersing time is 4.75

Also moderate scouring.

- **Drop Test**

In a pipet water is taken and water drop are dropped on the scoured fabric and the absorption of the water drop is observed visually.

The standard time for the absorption of one drop is 0.5-0.8 sec upto 1 sec.

Expt. Sample require 6 sec. i.e. not good scouring

- **Spot test**

In a pipette a solution of 1% direct red (Congo red) is taken and droplet of solution put on the different places of the fabric. Then the shape of the absorption area on the fabric is observed.

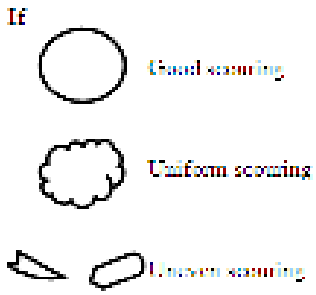

Figure 3.1: Scoured result type of samples

From Sample Spot uniform scouring can be said.

3.1.3. Quality of bleached fabric for the next process

Since the main objective of bleaching is to transform textile goods into high, uniform whiteness, the most important assessment of textile goods is assessment of whiteness. This is done by:

Magnesium oxide or Barium sulphate test

Comparing the sample against a standard which can be magnesium oxide or barium sulphate. The standard has 100% reflectance at all wavelengths. For bleached samples the reflectance at

460 nm (blue region) is measured. Unbleached cotton shows a reflectance of 55% which increases to 83-85% on bleaching.

Other whiteness calibrations take into account the reflectance at short as well as long wavelengths (for blueness and redness respectively).

$$W \text{ (Harisson)} = 100-(R_{670}–R_{430}) \text{ and}$$

$$W \text{ (Stephensen)} = R_{430} (R_{670}- R_{430})$$

The term R_{430} refers to the yellowness which reduces whiteness.

3.1.4. Quality of mercerized fabric

There are various methods to to test the quality of mercerization. These are:

i) Lustre, %: The mercerized sample is illuminated at an angle of incidence of 45 degree with the help of filament lamp. Light reflected at 45 degree and 90 degree is measured by photo electric cell. Lustre is defind by the contrast ratio of specular to diffuse reflectance. The specular reflectance measurement method is considered as an accurate evaluation of lustre.

Figure 3.2: reflection of mercerized cotton fabric

Lustre = contrast ratio of specular to diffuse reflectance

Lustre= Light reflected at 45 degree/ light reflected at 90 degree

ii) Microscopic examination: The test involves the assessment of degree of mercerization by counting the number of twisted and untwisted fibres (deconvolution count) while viewing through the microscope. If the sample under investigation is immersed in a solution containing 20 g iodine in 100 ml potassium iodide for 3 seconds and then wash off well, mercerized cotton will be stained bluish black and unmercerised cotton will be white.

iii) Deconvolution count: Under this mercerised fibres are cut down and examine under microscope and fibre with and without convolution are counted. The numbers of fibres without convolution per 100 fibres is called "Deconvolution Count" Generally percent unconvoluted

fibres are measured. Generally the unconvoluted fibre(%) in the unmercerized cotton is around 5 to 15 %, while in fully mercerized it become upto 80%.

iv Barium Activity Number: The degree of mercerization can be measured by this test. In increase in absorption properties are shown by alkali's, the ratio of soda absorbed by mercerized to that by the unmercerized cotton may be used as a parameter of the degree to which the cellulose has been swollen. From the practical point of view, Barium hydroxide number is very easy to estimate, and the ratio of uptakes for this reagent is referred to as the barium activity number. In the test, the mercerized and unmerserized samples weighing 1 g were treated with 30 ml of 0.25 N Barium hydroxide solution for 2 hours. Then 10 ml of solution (with few drops of phenolphthalein indicator) from that was titrated against 0.1 N hydrochloric acid (pink colour to colourless). A blank was also run without any fibre sample. The barium activity number is measured by using following formula:

Barium activity number = {(B-M) X 100}/ (B-U)

Where B is the titration reading for blank, M for mercerised and U for unmercerized. While unmercerized cotton gives a barium activity number of 100, it ranges between 115 to 130 for mercerized fabric and 150-160 for mercerised yarns.

3.2. Load, start and monitor pretreatment process

3.2.1. Oxidative/ Enzymatic Desizing Operation

→ Set the desizing machine according to the work order and the product specification

→ Prepare water in the desizing machine according to liquor ratio.

→ Prepare desizing solution on an individual beakers based on their recipe.

→ Prepare the grey fabric, and load on to the desizing machine.

→ Immerse the grey fabric in to desizing solution & start the desizing operation based on its stated MLR condition.

→ Observe and supervise the process until the final required product is achieved.

→ Then rinse with hot water and give a cold wash.

→ Dry and condition the sample before weighing.

→ Level the treated samples after weighing.

→ Carry out the quality parameters of the output fabric

3.2.2. Scouring Operation

→ Set the scouring machine according to the work order and the product specification
→ Prepare water in the scouring machine according to liquor ratio.
→ Prepare scouring chemicals on an individual beakers based on their recipe and add to the machine by considering appropriate safety precautions.
→ Prepare the desized fabric, and load it on to the boiling kier.
→ Immerse the desized fabric in to scuring solution & start the scouring operation based on its stated MLR condition.
→ Observe and supervise the scouring process until the final required product is achieved.
→ Then rinse with hot water and then a cold wash.
→ Dry and condition the sample before weighing.
→ Level the treated samples after weighing.
→ Carry out the quality parameters of the output fabric

3.2.3. Bleaching Operation

→ Set the bleaching machine according to the work order and the product specification.
→ Prepare water in the bleaching machine according to liquor ratio.
→ Prepare bleaching chemicals on an individual beakers based on their recipe and add to the machine by considering appropriate safety precautions.
→ Prepare the scoured fabric, and load it on to the bleaching machine.
→ Immerse the scoured fabric in to bleaching solution & start the whitening operation based on its stated MLR condition.
→ Observe and supervise the bleaching process until the final acceptable required product is achieved.
→ Then rinse with hot water and then a cold wash.
→ Dry and condition the sample before weighing.
→ Level the treated samples after weighing.
→ Carry out the quality parameters of the output fabric

3.2.4. Combined Pretreatment Operation

→ Set the single state machine according to the work order and the product specification.
→ Prepare water in the combined pretreatment machine according to liquor ratio.
→ Prepare required overall chemicals on an individual beakers based on their recipe and add to the machine by considering appropriate safety precautions.

→ Prepare the grey fabric, and load it on to the combined pretreatment machine.

→ Immerse the grey fabric in to the prepared solution & start the combined pretreatment operation based on its stated MLR condition.

→ Observe and supervise the combined pretreatment process until the final acceptable required product is achieved.

→ Then rinse with hot water and then a cold wash.

→ Dry and condition the sample before weighing.

→ Level the treated samples after weighing.

→ Carry out the quality parameters of the output fabric

3.2.5. Mercerization Operation

→ Set the mercerizer machine according to the work order and the product specification.

→ Prepare water in the mercerizer machine according to liquor ratio.

→ Prepare required overall chemicals on an individual beakers based on their recipe and add to the machine by considering appropriate safety precautions.

→ Prepare the bleached fabric, and load it on to the combined pretreatment machine.

→ Immerse the bleached fabric in to the prepared solution & start the combined pretreatment operation based on its stated MLR condition.

→ Observe and supervise the bleached process until the final acceptable required product is achieved.

→ Then rinse with hot water and then a cold wash.

→ Dry and condition the sample before weighing.

→ Level the treated samples after weighing.

→ Carry out the quality parameters of the output fabric

3.2.6. Washing/ Drying Operation

→ Set the washing and drying machine according to the work order and the product specification.

→ Prepare water in the washing machine according to liquor ratio.

→ Prepare required overall chemicals on an individual beakers based on their recipe and add to the washing machine by considering appropriate safety precautions.

→ Prepare the bleached/mercerized fabric, and load it on to the washing machine.

→ Immerse the bleached/mercerized fabric in to the prepared solution in the washing machine & start the operation of the mercerization based on its stated MLR condition.

→ Observe and supervise the washing process until the final acceptable required product is achieved.

→ Then after washing proceed the washed & finished pretreated white fabric to the subsequent drying part of the machine.

→ Dry and condition the pretreated fabric before weighing.

→ Level the treated samples after weighing.

→ Carry out the quality parameters of the output fabric

3.3. Pretreatment Process & Product Faults

3.3.1. Process and Product faults

Residual starch: During the sizing process of treatment it is expected to be that all most all textile size added impurities should be removed by using either of one of the desizing methods which are acid desizing, enzymatic desizing, rot steeping and peroxies. After the capillary test or absorbency tests are conducted by using droplet tests, the desized fabrics which does not have fullfil the required quality parameter will be regarded as the defect is happened by un-effective desizing operations and processes. The problem which identified are corrected by either doing the work again or by removing the imperfection by subjecting to the next process.

Poor absorbency – it is a required criteria for desizing and scouring operations, mostly it is resembled for scouring process. As the grey fabric which is intended to be scoured has contained most of the waxy and oily nature of the impurities it should be removed as much as possible for achieving the desired quality output. The inability of achieving non unacceptable degree in quality will be recognized as a defect which compromises the quality of the next processes mainly the coloration section. Corrective action may be reworking the pretreatment operation should be given for having a good finished product.

Poor whiteness – this is a major problem which is seen in the bleaching operation rather than the rest concurrent operations. Whiteness problem disturbs the required and intended whiteness of the fabric when checked with the quality whiteness index parameters. If the performed bleached fabric has a quality of less than the expected one, it will be recognized as the process which was

done was fault and corrective action will be given during or after the bleaching operation. Here it should be noted that compromising about the quality standards should not be compromised as it leads in revenue deduction of the textile factories.

Oil-Staining – Stain is an area of discoloration that penetrated the cloth surface, caused by a local deposit of soil or discoloration on a textile substrate that exhibits some degree of resistance to removal, as this results the poor staining operation. This is recorded as a process fault and for keeping the coloration marks, poor dye up-take and uneven dyeing issues during the next process, it should be reworked again.

3.4. Report the pretreatment operation

A product report is a report that displays key data on the goods your business sells. Such data may vary depending on the needs and objectives of the project report. It may provide information on inventory, sales, discounts, net and gross revenues, etc. during the pretreatment operation any type of work related issues should be reported such as:

→ Check the product fault

→ Identify the types of faults example, desizing defect, uneven scouring, less test performance and overall operationg problems and faults during the manufacturing process based on the following reporting format.

Table 3.1: Daily production record and report format

List of machines	Working hours (Shifts)								Total product
	1ST Hr.	2nd Hr.	3rd Hr.	4thH Hr.	5th Hr.	6th Hr.	7th Hr.	8th Hr.	
M/C 1									
M/C 2									
M/C 3									
M/C 4									
M/C 5									

Self-Check 3	True/False, Multiple Choice & Blank Test

Name _____ ***I.D*** _____ ***Date*** _____

Directions: Answer all the questions listed below.

Test I: True/False Questions

1. Microscopic examination the test involves the assessment of degree of mercerization by counting the number of twisted and untwisted fibres while viewing through the microscope.
2. Washing is used to add the required chemicals on to the textile fiber to ger a quality output product.
3. Without performing a pretreatment operation it is possible to get a quality dyed fabric.
4. Deconvolution count for mercerised fibres are cut down and examined under microscope and fibre with and without convolution are counted.
5. Absorbency test are determined by Drop test, Spot test, Immersion test and column test.

Test II: Multiple Choice Questions.

1. Which desizing efficiency value of is considered to be excellent

   A. 90% B. 70% C. 80% D. 60%

2. The standard time of immersing during conducting the immersion test is

   A. 5sec B. 10 sec C. 20 sec D. 15 sec

3. Pipet water is taken and water drop are dropped on the scoured fabric used for testing

   A. Spot test B. Droplet test C. Spot test D. Immersion test

4. One of the quality determinant parameter of a mercerized fabric is:

   A. Luster B. Bleach C. Hydrophobic D. Immerse

Test III: Short Answer Questions.

1. What are the main the chemicals which are used for oxidative desizing operation.
2. List out the main the chemicals which are used for enzymatic desizing operation.
3. Mention are the main the chemicals which are used for scouring operation.
4. List the main the chemicals which are used for oxidative bleaching operation.
5. Mention the main the chemicals which are used for combined pretreatment operation.
6. What are the main the chemicals which are used for mercerization operation.
7. Mention the main the chemicals which are used for washing operation.
8. What is the standard time for the absorption of one drop for checking the quality of scoured fabric?

Operation Sheet 1	
Operation Title	Oxidative desizing of cotton fabrics
Purpose	To remove the added size material from the fibers and obtaining an acceptable degree of desized fabric which fits for the subsequent scouring operation.
Instruction	By using the given chemicals recipe which is found in table 2.1, perform the oxidative desizing operation.
Tools, Equipment and Materials	Grey fabric, Hydrogen peroxide (35%), Caustic Soda (100%), Sodium silicate, Magnesium Sulphate, DTPA, beaker, thermometer, Litmus Pater, stirrer, stove, weighing balance, scissor, meter.
Precautions	→ Follow the correct procedure/steps in listed above. → Perform the given operation based on the operational requirement including by applying standard occupational health and safety rule.
Procedures in doing the task	→ Review learning guide → Identify necessary equipment & tools → Follow the procedure which is found in (**3.2.1.**) correctly
Conditions or situations for the operation	→ The practical class room (pretreatment laboratory) safe and well organized. → The class room must be suitable and chemicals set in orders in the lab shelf. → Instruments and machineries available in working lab (safe arrangement).
Quality criteria	→ Absorbency test by using a water drop test

Operation Sheet 2	
Operation Title	Enzymatic desizing of cotton fabrics
Purpose	To remove the added size material from the fibers and obtaining an acceptable degree of desized fabric which fits for the subsequent scouring operation.
Instruction	By using the given chemicals recipe which is found in table 2.2, perform the enzymatic desizing operation.
Tools, Equipment and Materials	Grey fabric, Enzyme biolase, Sodium chloride, Non ionic wetting agent, beaker, thermometer, Litmus Pater, stirrer, stove, weighing balance, scissor, meter.
Precautions	→ Follow the correct procedure/steps in listed above. → Perform the given operation based on the operational requirement including by applying standard occupational health and safety rule.
Procedures in doing the task	→ Review learning guide → Identify necessary equipment & tools → Follow the procedure which is found in (**3.2.1.**) correctly
Conditions or situations for the operation	→ The practical class room (pretreatment laboratory) safe and well organized. → The class room must be suitable and chemicals set in orders in the lab shelf. → Instruments and machineries available in working lab (safe arrangement).
Quality criteria	→ Absorbency test by using a water drop test

Operation Sheet 3

Operation Title	Scouring of cotton fabrics
Purpose	To remove natural & added impurities like pectin, wax, oil, grease and non-fibrous impurities (e.g. the remains of seed fragments) from the fibers and any added soiling or dirt and obtaining an acceptable degree of whiteness which fits for the subsequent bleaching operation.
Instruction	By using the given chemicals recipe which is found in table 2.3, perform the scouring operation.
Tools, Equipment and Materials	Desized fabric, Caustic soda, Wetting agent, Water, beaker, thermometer, Litmus Pater, stirrer, stove, weighing balance, scissor, meter.
Precautions	→ Follow the correct procedure/steps in listed above. → Perform the given operation based on the operational requirement including by applying standard occupational health and safety rule.
Procedures in doing the task	→ Review learning guide → Identify necessary equipment & tools → Follow the procedure which is found in (**3.2.2.**) correctly
Conditions or situations for the operation	→ The practical class room (pretreatment laboratory) safe and well organized. → The class room must be suitable and chemicals set in orders in the lab shelf. → Instruments and machineries available in working lab (safe arrangement).
Quality criteria	→ Absorbency test by using a water drop test

Operation Sheet 4	
Operation Title	Bleaching of cotton fabrics
Purpose	To remove the natural impurities of cotton fiber and obtaining an acceptable aesthetic appearance with good degree of whiteness which fits for the subsequent operation.
Instruction	By using the given chemicals recipe which is found in table 2.4, perform the bleaching operation.
Tools, Equipment and Materials	Scoured fabric, Hydrogen peroxide, Caustic soda, Sodium carbonate, Sodium silicate, Magnesium Sulphate, Wetting agent + sequestering agent, beaker, thermometer, Litmus Pater, stirrer, stove, weighing balance, scissor, meter.
Precautions	→ Follow the correct procedure/steps in listed above. → Perform the given operation based on the operational requirement including by applying standard occupational health and safety rule.
Procedures in doing the task	→ Review learning guide → Identify necessary equipment & tools → Follow the procedure which is found in (**3.2.3.**) correctly
Conditions or situations for the operation	→ The practical class room (pretreatment laboratory) safe and well organized. → The class room must be suitable and chemicals set in orders in the lab shelf. → Instruments and machineries available in working lab (safe arrangement).
Quality criteria	→ Assure the degree of whiteness by using whiteness index test

Operation Sheet 5	
Operation Title	Single Stage (Combined) Pretreatment of cotton fabrics
Purpose	To remove the size matter, natural and added impurities and natural coloring impurities of cotton fibers for achieving an acceptable white textile substrate.
Instruction	By using the given chemicals recipe which are found in table 2.5, perform the combined pretreatment operation.
Tools, Equipment and Materials	Grey fabric, H_2O_2 , NaOH, Sodium silicate, Non-ionic wetting agent Sodium diphersulphate, beaker, thermometer, Litmus Pater, stirrer, stove, weighing balance, scissor, meter, grey fabric.
Precautions	→ Follow the correct procedure/steps in listed above. → Perform the given operation based on the operational requirement including by applying standard occupational health and safety rule.
Procedures in doing the task	→ Review learning guide → Identify necessary equipment & tools → Follow the procedure which is found in (**3.2.4.**) correctly
Conditions or situations for the operation	→ The practical class room (pretreatment laboratory) safe and well organized. → The class room must be suitable and chemicals set in orders in the lab shelf. → Instruments and machineries available in working lab (safe arrangement).
Quality criteria	→ Absorbency test by using a water drop test

Operation Sheet 6

Operation Title	Mercerization of cotton fabrics
Purpose	To remove the convoluted structure of the cotton fiber in to circular crossection by concentrated caustic soda solution which is essential for achieving a lustrous appearance and strengthens them.
Instruction	By using the given chemicals recipe which is found in table 2.6, perform the mercerization operation.
Tools, Equipment and Materials	Bleached fabric, Concentration of NaOH, Wetting agent, Acetic acid, beaker, thermometer, Litmus Pater, stirrer, stove, weighing balance, scissor, meter.
Precautions	→ Follow the correct procedure/steps in listed above. → Perform the given operation based on the operational requirement including by applying standard occupational health and safety rule.
Procedures in doing the task	→ Review learning guide → Identify necessary equipment & tools → Follow the procedure which is found in (**3.2.5.**) correctly
Conditions or situations for the operation	→ The practical class room (pretreatment laboratory) safe and well organized. → The class room must be suitable and chemicals set in orders in the lab shelf. → Instruments and machineries available in working lab (safe arrangement).
Quality criteria	→ Absorbency test by using a water drop test

Operation Sheet 7

Operation Title	Washing and Drying of cotton fabrics
Purpose	To remove the size matter, natural and added impurities and natural coloring impurities of cotton fibers by washing for achieving an acceptable white textile substrate by drying.
Instruction	By using the given chemicals recipe which is found in table 2.7, perform the washing operation.
Tools, Equipment and Materials	Pretreated wet fabric, Hot water, Detergent, Acetic acid, beaker, thermometer, Litmus Pater, stirrer, stove, weighing balance, scissor, meter, pretreated wet fabric.
Precautions	→ Follow the correct procedure/steps in listed above. → Perform the given operation based on the operational requirement including by applying standard occupational health and safety rule.
Procedures in doing the task	→ Review all the unit of learning guide → Identify necessary equipment & tools → Follow the procedure which is found in (**3.2.6.**) correctly
Conditions or situations for the operation	→ The practical class room (pretreatment laboratory) safe and well organized. → The class room must be suitable and chemicals set in orders in the lab shelf. → Instruments and machineries available in working lab (safe arrangement).
Quality criteria	→ Whiteness, wettability test and assuring whether the washed fabric is at a neutral state or not.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Part I. Practical Demonstration on Oxidative/ Enzymatic Desizing Operation

Time started: _____ **Time finished**: _____

Instructions: Given necessary templates, tools, equipments and materials you are required to perform the following tasks within 1 hours for oxidative desizing and 2 hours for enzymatic practical parts.

Task 1: Identify the required materials, tools and equipments for doing the required activity.

Task 2: Check the materials, tools and equipment for the operation for correct required output.

Task 3: Carry out the practical activity based on the given operation sheet 1 for oxidative desizing and operation sheet 2 for enzymztic desizing as seen on page number **43** and **44** respectively.

Task4: Record the work done, check its quality and report.

Part II. Practical Demonstration on Scouring Operation

Time started: _____ **Time finished**: _____

Instructions: Given necessary templates, tools, equipments and materials you are required to perform the following tasks within 3 hours for each practical parts.

Task 1: Identify the required materials, tools and equipments for doing the required activity.

Task 2: Check the materials, tools and equipment for the operation for correct required output.

Task 3: Carry out the practical activity based on the given operation sheet 3 as seen on page number **45**.

Task4: Record the work done, check its quality and report.

Part III. Practical Demonstration on Bleaching Operation

Time started: _____ **Time finished**: _____

Instructions: Given necessary templates, tools, equipments and materials you are required to perform the following tasks within 2 hours for each practical parts.

Task 1: Identify the required materials, tools and equipments for doing the required activity.

Task 2: Check the materials, tools and equipment for the operation for correct required output.

Task 3: Carry out the practical activity based on the given operation sheet 4 as seen on page number **46**.

Task4: Record the work done, check its quality and report.

Part IV. Practical Demonstration on Combined Pretreatment Operation

Time started: _____ **Time finished**: _____

Instructions: Given necessary templates, tools, equipments and materials you are required to perform the following tasks within 2 hours for each practical parts.

Task 1: Identify the required materials, tools and equipments for doing the required activity.

Task 2: Check the materials, tools and equipment for the operation for correct required output.

Task 3: Carry out the practical activity based on the given operation sheet 5 as seen on page number **47**.

Task4: Record the work done, check its quality and report.

Part V. Practical Demonstration on Mercerization Operation

Time started: _____ **Time finished**: _____

Instructions: Given necessary templates, tools, equipments and materials you are required to perform the following tasks within 30 min for each practical parts.

Task 1: Identify the required materials, tools and equipments for doing the required activity.

Task 2: Check the materials, tools and equipment for the operation for correct required output.

Task 3: Carry out the practical activity based on the given operation sheet 6 as seen on page number **48**.

Task4: Record the work done, check its quality and report.

Part VI. Practical Demonstration on Washing/Drying Operation

Time started: _____ **Time finished**: _____

Instructions: Given necessary templates, tools, equipments and materials you are required to perform the following tasks within 30 minutes for each practical parts.

Task 1: Identify the required materials, tools and equipments for doing the required activity.

Task 2: Check the materials, tools and equipment for the operation for correct required output.

Task 3: Carry out the practical activity based on the given operation sheet 7 as seen on page number **49**.

Task4: Record the work done, check its quality and report.

Unit Four: Remove product and dispatch

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- → The concept of Product quality
- → Doffing and dispatching product
- → Production records

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- ☺ Understanding the concept of product quality
- ☺ Perform Doffing and dispatching product
- ☺ Completing production records

4.1. The concept of Product quality

Product quality refers to how well a product satisfies customer needs, serves its purpose and meets industry standards. When evaluating product quality, businesses consider several key factors, including whether a product solves a problem, works efficiently or suits customers' purposes.

Companies may also evaluate product quality based on various perspectives that show how different groups perceive the usefulness of a product. Perspectives to consider when assessing product quality include customer perspectives, manufacturing perspectives, product-based and value-based perspectives and transcendental perspectives, which perceive a product's value in relation to its cost.

Using these perspectives, you can define product quality according to:

- Performance and intended function
- Reliability of the product within a specific time frame
- Conformity to product specifications
- Product durability and lifespan
- Product serviceability
- Physical features of the product
- Customers' perception of the product

Importance of product quality

Product quality is important because it affects the success of the company and helps establish its reputation in customer markets. When companies can create high-quality products that continue to meet customer demands, it can lead to fewer production costs, higher investment returns and increases in revenue.

Product quality also matters to the customers who depend on a company's attention to detail and customer demand. Companies create products to fill a need in the market, and consumers expect products to meet that need as the company advertises them. They want products that help them establish a connection with a brand so they know they can rely on the company's offerings. Quality products provide customers with safe, effective ways to solve their problems.

4.2. Doffing and dispatching product

Doffing means removed the pretreated product from the pretreatment machine by using load shifting equipment or manually after the process has been done. While unloading we assure that the using of OHS and following of machine manufacturer‘s procedure**.**

Product dispatching is activity that is performed after the product is doffed and checked to confirm the required standard. So product dispatching is simply distributing the prepared product to the next line process or customers for use.

Dispatching is the routine of setting productive activities in motion through the release of orders and necessary instructions according to pre-planned times and sequence of operations embodied in route sheets and loading schedules. In other words, once a job is in an area where an operation is to be performed, it has to be determined when and by whom the job will be processed and also the sequence of waiting orders to be processed. The decision of assigning the various jobs to different machines and equipment is called Dispatching.

The companies provide suitable transportation vehicles like trucks to ensure the safety and timely delivery of the goods. They are the experts as they know how to place the goods in the transportation vehicle so that goods don’t get damaged while the vehicle is moving. The service should be highly systematic, organized and reliable without causing any anxiety to the customers.

4.3. Production records

Record means that compile a data or datum of something; either production, quality, raw material, absenteeism, faults or other. And it can be recorded indifferent ways. Let see the following hourly production record interims of table.

- Record the quality of pretreated product
- Record the amount products
- Record specification of product against to standards
- Record the limitation, strength and weakness of products
- Confirm the products against to all quality requirements

Self-Check 4	True/False, Multiple Choice & Blank Test

Name _____ ***I.D*** _____ ***Date*** _____

Directions: Answer all the questions listed below.

Test I: True/False questions

1. Recording the performed work does not have value for using as a future reference.
2. The recording ways of encoding the work which is performed can be documented in a rigid one way.
3. Doffing means removed the pretreated product from the printing machine by using load shifting equipment or manually after the process has been done.
4. Companies have the right to evaluate product quality based on various perspectives that show how different groups perceive the usefulness of a product.
5. During unloading the pretreatment machines giving value for OHS rules has no value.

Test II: Short Answer Questions.

1. The decision of assigning the various jobs to different machines and equipment is called _____.
2. _____ refers to how well a product satisfies customer needs, serves its purpose and meets industry standards.
3. _____ products provide customers with safe, effective ways to solve their problems.
4. Product quality has no an important value as it affects the success of the company and helps establish its reputation in customer markets.
5. _____ is activity that is performed after the product is doffed and checked to confirm the required standard.
6. _____ means that compile a data or datum of something; either production, quality, raw material, absenteeism, faults or other.

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