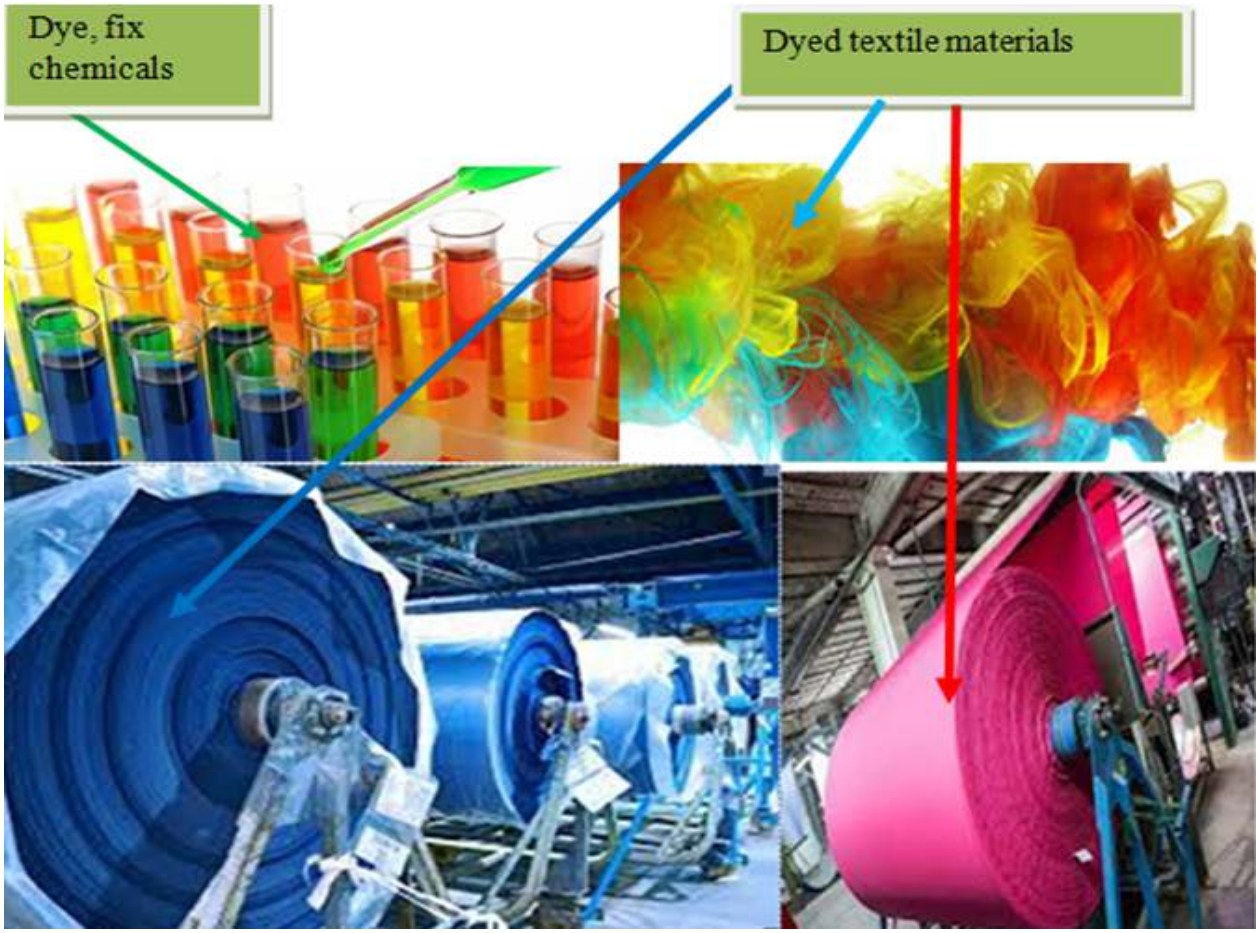
Textile Processing Technology

Level-I

Based on March, 2022, Curriculum Version 1



Module Title: -Performing Dying Operations

Module code: INDTPT1M06 0322

Nominal duration: 120Hour

Prepared by: Ministry of Labour and Skill

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Contents

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Acknowledgment

First of all I would like thanks to everlasting for everything to god, 2ndly Ministry of Labor and Skills, Ministry of industry wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry experts, sectors experts who donated their time, attention and expertise to the development of this Teaching, Training and Learning Materials (TTLM) well.

Acronym

- SOP = Standard Operation Procedure.
- PPE = Personal Protective Equipment.
- WHS = Work Health and Safety.
- B.C = Before Christ.
- COD = Chemical Oxygen Demand.
- LAP = Learning Activity Performance.
- NCMR = Non-Conforming Material Report
- DNA = Deoxyribonucleic Acid
- SCAR = Supplier Corrective Action Request

Introduction to the module

Dyeing of textiles is usually understood to mean giving them a colour to textile materials/product/which is of comparative permanence. Within this module traine will understood something about the meaning and historical background of pretreatment (preconditioning activity or preparation for dyeing), dyeing and finishing of textile product. It also defined as a means of imparting or giving color to the whole volume of textile material uniformly.

It is a method for coloring a textile material in which a dye is applied to the substrate in a uniform manner to obtain an even shade with a performance and fastness appropriate to its final use. Dyeing is a process of imparting color to the fabric and increase the aesthetic value of it.

It is believed that dyeing was practiced as early as 3000 B.C. in China, although no conclusive proof of this is available. The earliest records of Indian religious and social practices belong to the period of about 2500 B.C., and they contain references to coloured

silk and gold brocades from which it can be concluded that dyeing was then already an established practice. It could be that the craft was transmitted through Persia to Egypt. Relics of ancient civilization have been better preserved and more thoroughly explored in Egypt than in any other Eastern country. From paintings on the walls of tombs it can be inferred that as long ago as 3000 B.C. the Egyptians were making coloured mats which they hung on their walls. It has also been established beyond doubt that Dyer's thistle, also known as Safflower, was in use in 2500 B.C. to produce red and yellow shades. By about 1450 B.C, the Egyptians were making textile materials of astonishingly delicate structure and were able to dye them in a whole range of different colours. In the chronological sequence of history, classical civilization followed that of the Far and Middle East.

This module covers the units

- Job requirements
- Dyeing processes
- Dyeing machine
- Dyeing operations
- Dye outcomes

Learning Objective of the Module

- Determine job requirements
- Understand dyeing processes
- Operate and monitor dyeing machine
- Complete dyeing operations
- Check dye outcomes

Module Instruction

For effective use this modules 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" giver at the end of each unit and
5. Read the identified reference book for Examples and exercise

Unit one: Job requirements

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)
- Hazard identification and control
- Risk assessment and implementation
- Risk reduction measures
- 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:

- Apply Standard operating procedures (SOPs)
- Comply with work health and safety (WHS)
- Hazard identification and control
- Risk assessment and implementation
- Risk reduction measures
- Use appropriate personal protective equipment (PPE)
- Identify job requirements

1.1 Standard operating procedures (SOPs)

The general concepts of Standard operating procedures (SOP) is a procedure specific to your operation that describes the activities necessary

Any document that is a “how to” falls into the category of procedures. In a manufacturing environment, the most obvious example

Of an SOP is the step by step production line procedures used to make products as well train staff. SOPs are policies, procedures and standards you need in the operations, marketing and administration disciplines within your business to ensure success. These can create:

• Efficiencies, and therefore profitability

• Consistency and reliability in production and service.

- Fewer errors in all areas

• A way to resolve conflicts between partners

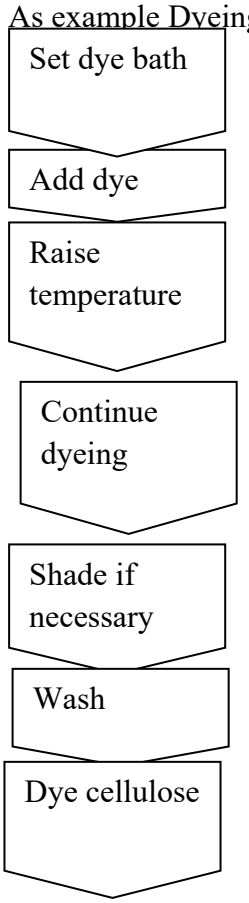
• A healthy and safe environment

• Protection of employers in areas of potential liability and personnel matters

• A roadmap for how to resolve issues and the removal of emotion from troubleshooting

As example Dyeing Operation

As example Dyeing Operation



Set machine with water at 40^0c and the polyester/cellulosic and then:

- Add dispersing agent
- Add carrier
- Adjust the PH to 5-5.5 with sodium acetate/acetic acid

Add disperse dyes

Raise the temperature to the boil over 30 minutes.

Continue to dye for 60-90 minutes.

Shade as required by adding disperse dyes and continue to dye for a further 30 minutes at boil.

As result SOP in textile terry dyeing needs consistency in its process for getting accurate results. So that dyeing or standard operating procedure (sop) for dyeing process is so important in the textile industry. Dyeing is a repeating procedure. We need to do the same work several times a day. This is the full dyeing operating process (sop) from knitted gray fabric to finish fabric. The dyeing process sop depends on the type of fabric, yarn, and fiber.

The Batch section receives fabric from the grey fabric store.

⇩

Prepare the batch according to the dyeing machine capacity, color, lot, etc & provide a batch number for further follow-ups up to finishing.

⇩

Batching QC team cross-checks the batching procedure & ensures the batching whether it is done properly or not. They check the quality & quantity of the batch before sending it to the next process.

⇩

Batched fabric is sent for singeing for removing the hairiness of the fabric. Heat setting is done at 190-200 °C temperature.

⇩

The dyeing section receives the fabric & starts the pretreatment process i.e demineralization, scouring, bleaching for removing the impurities of the fabric at a certain temperature.

⇩

The dyeing machine operator operates the machine & completes the process of dying by dosing dyes & chemicals as per instruction. Dyeing online QA concern randomly checks the parameters of dyeing.

⇩

Unload the batch after treatment

⇩

Complete the whole finishing process with one roll (first roll). If pass follows the parameter for the whole batch. If not ok then reprocess that roll to correction

⇩

After dyeing, Finishing Section receives the fabric; fabric is opened by a slitting machine following the needle mark.

⇩

Fabric is dried at center/dryer machine to adjust the dia & GSM of the fabric by giving specific pressure, temperature & overfeed at a specific speed. Softener is added for giving the fabric a smooth hand feels.

⇩

For fleece fabric, the fabric is sent to the brush & peach finish machine. This process is to be done as per buyer requirements.

⇩

For readjustment of dia & GSM after peach, brush process the fabric is sent to Stentor machine as per work instruction.

⇩

Finally, the fabric is finished in compacting machine by controlling dia & GSM.

⇩

Online quality controller checks all types of process parameters & quality of the fabric during the production process.

1.2 Work health and safety (WHS)

Workplace Health and Safety (WHS) is the term used to describe the measures your business puts in place to protect its employees, contractors and, in fact, anyone on its premises. WHS involves continually assessing your organization's practices and standards, to ensure that it comply with government regulations and that any potential safety risks are eliminated or minimized.

Work health and safety (WHS) – sometimes called occupational health and safety (OH&S) – involves the management of risks to the health and safety of everyone in your workplace. This includes the health and safety of anyone who does work for you as well as your customers, visitors and suppliers.

We all have a right to be safe at work, whatever our role. However, ensuring that happens involves understanding and accepting government legislation as well as demonstrating a true organizational wide commitment to safety. We need to consider industry best safety practices and take the necessary guidance and safe systems of work when the risk profile of the task requires it. The alternative is having an unsafe workplace, where your employees and third-party contractors are at risk of injury or worse.

When WHS legislation applies to your organization, you must ensure, so far as is reasonably practicable, the health and safety of everyone working for you. While you can't guarantee that no harm will ever occur, if you are WHS compliant, you will be able to demonstrate your efforts toward workplace health and safety.

To adhere to your WHS responsibilities, you need to understand the nature of your business and its related hazards and risks, and then ensure that you've used the necessary resources and processes to eliminate or minimize those risks. Meeting all of the WHS requirements and achieving WHS compliance can seem like a significant challenge. However, compliance is an ongoing process rather than a one-off task, and by striving towards compliance, your business can realize many benefits:

- Minimize the risk of injury or illness
- Reduce public liability claims
- Lower the cost of worker's compensation
- Increase staff retention
- Boost employee productivity

1.2.1 Hazard identification and control

Hazard is any think that has the potential to cause harm. E.g. chemicals whereas A Risk assessment is simply a careful examination of what, in your work could cause harm to people, so that you can weigh up whether you have taken enough precautions or should do more to prevent harm. There are two primary control strategies; Control the Hazard and Control Exposure to the Hazard. These two strategies are commonly addressed through the Hierarchy of Controls. The Hierarchy of Controls can be arranged into several different groupings. Generally speaking, and when feasible, controlling the hazard is more effective than controlling the exposure.

Hazard Control

- **Elimination** – Physically removing the hazard from the workplace is the most effective hazard control. No hazard = no risk.
- **Dye hazards**: The dyeing process is the most hazards process among all the textile industry processes. The hazards are caused due to the chemicals used in the dyeing. The chemicals as a common have some hazards which will lead to severe affects when it's exposed continuously as well as it leads to fire when not stored properly. The improper treatment of water leads to the effect of water streams thus affecting both aquatic and terrestrial life. Some of these very hazards chemicals include Benzedrine, hydro's, potassium dichromate, alkyl amine, e.t.c,

Chemical Hazards: chemicals such as hypochlorite used as bleaching solution possess gaseous substance chlorine. When the workers come in contact with dangerous level of chlorine they develop skin irritation, mucous membrane gets affected and thus leading to pulmonary tissue damage thus causing lung edema. The acid and alkalis used in dying process for treatment of cloth with boiling liquor expose the workers are risk to the burns and scalds. Chromium becomes hazardous when it strikes the person. Aromatic amines used in dying industries have the capability of DNA mutation. Most of the dye stuff used in the industries is skin irritants. .

Sulfur dyes (are synthetic organic substantive materials dyes for cellulosic Sulphur dyes are water insoluble dyes hence it's made soluble by addition of alkaline compounds such as sodium sulphide or sodium hydrosulphite which acts as a reducing agent. It also uses oxidizing agents such as sodium dichromate and hydrogen Peroxide.

S.NO	HAZARDS	CAUSE	EFFECT	REMEDIAL MEASURES
			PHYSICAL HAZARDS	
1	Noise	• Simple gear, • Continuous gear train, • Chain drive, • Bevel drive, • Worm and worm wheel • Variable drive.	• Sound levels cause trauma to the cochlear structure in the inner ear. • It will cause high blood pressure. • It affects sleep and work performance	• Isolation of the machine and Silencer must be kept. • Inverted drive control noise in ring frame. • Proper maintenance lubricating control noise.
2	Dust	• Cotton • Fiber particles	• Causes respiratory problems and causes Byssinosis	• Dust collector, • Proper Housekeeping • Necessary PPE should were by worker.
3	Lighting	• High beam and Low beam of light	• Eye strain • Glaring and • Irritation of eye	• Proper lightning condition • Provide safety goggles for reduce eye strain for improper lighting condition.

Figure 1.1. Hazards

1.2.2 Hazard Identification and Control Fact Sheet

• Heat and Temperature may be due to examples such as: o the environment, o chemical reactions, o combustion, o electrical current, and o mechanical motion.

• Flammability / Fire

• Explosives – including chemicals, dusts, solids, vapors, gases and equipment.

• Pressure Hazards – including ruptured cylinders, whipping hoses and lines and water hammer.

• Electrical Contact – including shock, ignition of combustibles, overheating of equipment, arc flash and inadvertent activation of equipment.

1.2.3 Risk assessment and implementation

The definition of a 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. When completing a risk assessment, it is important to clearly define some keywords:

- **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.’

Types of Hazards in the Workplace

• Falls

• Impacts either Struck by or Struck against.

• Noise, frequency vibration, and toxics.

Steps in risk assessment

- Identify the hazards
- Decide who might be harmed and how
- Evaluate the risk and decide on operation dyeing operation wear safety shoe, goggle, and chemical suit, respiratory to protect the respiratory system from inhalation of dye particles.
- Use gloves from handle dyestuff, provide sanitary facilities, Record your finding and implement them,
- Documenting risk assessment, and Record basic information.

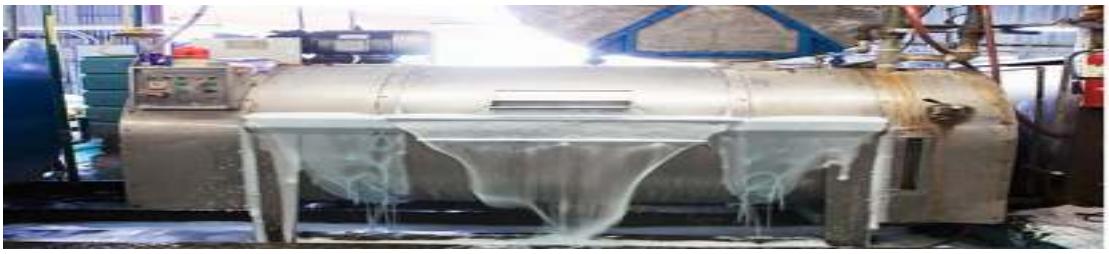


Figure 1.2.Risk

Figure 1.3. Risk assessment

The main risks are physical, chemical, ergonomics and physiologically, working hours, incorrect ventilation, dust chemical and noise are some of the things that can cause harm. Textile industries involve diverse operation including fiber synthesis weaving manufacturing, dyeing and finishing. Textile operations have been studied extensively and found numerous health and safety issues associated with the textile industry materials, exposure to cotton and other organic dusts, musculoskeletal stresses and noise exposure.

1.2.4 Risk reduction measures

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.

(a)Eliminate and minimize hazards by design (inherently safer design),

(b)Prevent (reduction of likelihood),

(c)Detect (transmission of information to control point),

(d)Control (limitation of scale, intensity and duration),

(e)Mitigate consequences (protection from effects), and

(f)Emergency response plans (spill, well control, blow out, drive off/drift off, etc.).

Synthetic dyes have provided a wide range of colorfast, bright hues. However their toxic nature has become a cause of grave concern to environmentalists. Use of synthetic dyes has an adverse effect on all forms of life. Presence of sulphur, naphthol, vat dyes, nitrates, acetic acid, soaps, enzymes chromium compounds and heavy metals like copper, arsenic, lead, cadmium, mercury, nickel, and cobalt and certain auxiliary chemicals all collectively make the textile effluent highly toxic. Other harmful chemicals present in the water may be formaldehyde based dye fixing agents, chlorinated stain removers, hydro carbon based

softeners, non-bio degradable dyeing chemicals. The colloidal matter present along with colors and oily scum increases the turbidity, gives the water a bad appearance and foul smell and prevents the penetration of sunlight necessary for the process of photosynthesis.

1.3 Personal protective equipment (PPE)

Personal Protective Equipment (PPE) – This is the least effective means of controlling hazards because there are many factors that can render the PPE ineffective. PPE should always be considered the last line of defense and not the main or primary strategy for control.

Figure 1.4. PPE

Personal Protective Equipment (PPE) includes safety glasses, goggles, face shields, gloves, lab coats, aprons, ear plugs, and respirators. Hazard measuring, risk controls

Parameters	Location of the reading	Range	Mean
Lighting(lux)	Blow room	78-109	93.5
	Spinning area	51-60	55.5
	Ginning area	88-92	90
	Dyeing area	100-115	107.5
	Weaving area	90-95	92.5
Noise (dBA)	Spinning area	90-95	92.5
	Auto corner (off end & rear end)	86-89	87.5
	Weaving area	90-93	91.5
	Finishing area	85-90	87.5
Temperature(°c)	Preparatory unit	24 -30	27
	Spinning room	28-35	31.5
	Weaving room	25-33	29
	Dyeing room	32-37	34.5
	Fabric finishing room	30-34	32
Humidity (%)	Preparatory unit	--------	51.61
	Spinning room	--------	56.41
	Weaving room	--------	55.44
	Dyeing room	--------	57.83

Figure 1.5. Hazard measuring

1.4 Job requirements

- Defined as a piece of work, especially a specific task done as part of the routine of one's occupation or for an agreed price.
- A post of employment; full-time or part-time position
- Anything a person is expected or obliged to do; duty; responsibility
- An affair, matter, occurrence, or state of affairs.
- The material, project, assignment, etc., being worked upon.
- The process or requirements, details, etc., of working.
- The execution or performance of a task.

The requirements for a job vary according to the nature of the job itself. Since to our needs as individual or group, as general everybody should be understand the value of three pillars on human life style which is that knowledge, skill, and attitude of about the minimum background of pretreatment fabric type of dye, auxiliary chemicals and its process to satisfy owner and customer easily so such type of basic requirements for a job remain the same no matter what the job is, where it is located or what professional and educational qualifications are required for it.

- **Discipline:** Nothing is possible without discipline. Any job requires a fundamental core of discipline from the worker or the employee and this is a quality which is independent of age, post, stature, job and so on
- **Enthusiasm:** Enthusiasm for work is also a pre-requisite for any job. An innate love for the job, which in modern parlance is known as job satisfaction, is a core requirement for any job.
- **Qualifications:** This is a more material, tactile need for a job which can be conveyed through degrees and certificates. However education is not limited to what is taught in colleges or vocational training courses.

Self-check-1

Instruction I: write if the statement is correct say true or if the given statement is not correct say false

1. Hazard is a basic important thing.(2 points)
2. Personal protective equipment is **not** necessary for dyeing operation. (2 points)
3. The requirements for a job is the same according to the nature of the job itself.(2points)

InstructionII choose the best answer from the following alternative

1. From the following alternative which concept is true about personal protective equipment?

A/ use safety shoe B/ use safety glasses, C/eye goggles, D/ all the above

2. Among the following one is necessary for job requirement?

A/ qualify with practice about dyeing B/ good skill practice about dying, C/no need any requirement, D/ A&B

Instruction III:**:** write short answer for the given question. You are provided 3 minute for each question and each point has 5Points.

1. Define the word standard operation procedure in textile dying?
2. Write down at least three steps of standard operation procedure in textile dying?
3. Define the word risk in textile dying?
4. What is the difference between hazard and accidents?
5. Write is the important of PPE in textile dying

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

Unit Two: Dyeing processes
This unit is developed to provide you the necessary information regarding the following content coverage and topics: • Dyeing processes , technologies and its significance • Dyeing environmental effects and its significance. • Interaction of dyes • Interaction of chemicals • Interaction of dyes, Chemicals and auxiliaries with textiles. • Dyes, chemicals & auxiliaries' properties & functions 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: Understand dyeing processes , technologies and its significance • Understand dyeing environmental effects and its significance. • Understand interaction of dyes • Understand interaction of chemicals • Understand interaction of dyes, Chemicals and auxiliaries with textiles. • Identify dyes, chemicals & auxiliaries' properties & functions

1.1 Dyeing processes, technologies and its significance

Dyeing process is a process imparting or giving color to the whole volume of textile material and increase the aesthetic value of it. Dyeing can be done at any stage of the manufacturing of textile- fiber, yarn, fabric, or a finished textile product including garments and apparel. The

property of color fastness depends upon many factors- selection of proper dye according to the pretreatment, textile material to be dyed and selection of the method for dyeing the fiber, yarn, fabric, and garment part. to start the dyeing process students should be now something about the basic important requirement which is wet processing or pretreatment.

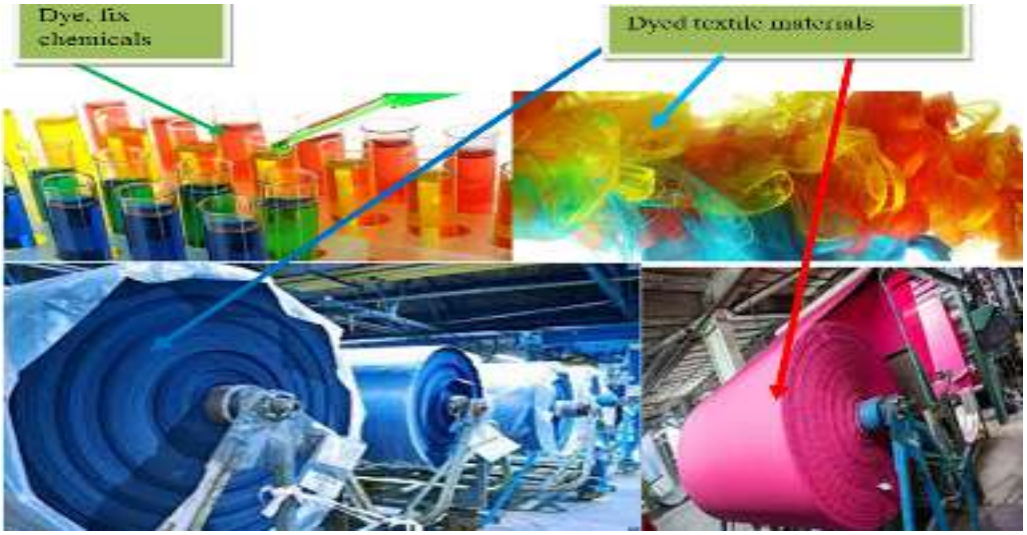


Figure 2.2.woven fabric dyeing process

In wet - processing the typical sequence of processes followed for the preparation are:

1. **Singeing**: A process where loose fibers and protruding fibers are burned away to get a clear and clean fabric surface.
2. **De-sizing**: A process where warp size is removed.
3. **Scouring**: A process where mill and natural dirt, waxes and grease are removed.
4. **Bleaching**: A process where natural colors (yellowish grey) are destroyed and the fabric is whitened.
5. **Mercerizing**: Caustic treatment of cellulosic fabrics improving luster, water absorbance, dye yield and fiber strength with improvement in dimensional stability.
6. **Carbonizing*:*** Acid treatment of wool for removing vegetable matter.
7. **Heat Setting**: Heat treatment of fabrics containing thermoplastic Synthetic fibers. Stabilizing of fabric by reducing shrinkage and distortion (Improving dimensional stability of Synthetic fibers and its blends

Figure 2.2.knitted fabric dyeing process

2.1.1 Phases of dyeing process

In general, dyeing can be described as a process in which a textile fibre absorbs the molecules of dye from its solution so that the dyed material retains the dye and resists the release of the dye back to the solution from which is has been absorbed. Dyeing processes which take place in water solutions of dyes are always distribution processes between two phases, i.e. dye solution and solid substrate, and they are based on physicochemical interactions between the molecules of dye and the substrate. These processes may be accompanied by chemical reactions between the dye molecules and the substrate, for example, in the case of vat, reactive and chrome dyes. In the case of disperse dyes, the second solid phase takes part in the process, that is the disperse particles of the dye. These particles dissolve in the water and thus the transport of the dye into the solid substrate takes place in a similar manner to that of water-soluble dyes. In contrast to these two cases, dyeing with pigments is based on the mechanical anchoring of the pigment particles on the surface of the substrate.

2.1.2 Factors affecting dyeing quality

The aim of successful dyeing is to ‘achieve the desired shade, at the right price, with sufficient levelness, whether dyeing loose fibre, yarn or piece goods, with sufficient colour fastness to withstand both processing and consumer demands, but without adversely affecting the fibre quality Of these, an acceptable level of uniform dye uptake at all parts of the substrate may be the most important criterion. The dyeing of a textile fiber is carried out in a solution, generally aqueous, known as the dye liquor or dye bath. For true dyeing to have taken place, coloration of fabric and absorption are important determinants.

- Due to Material**:**
- Uneven heat treatment.
- Due to Water Quality:
- Due to Improper Dye Solution**:**

2.1.3 Textile dyeing technologies

The industry is desperately in the need of newer and very efficient dyeing/finishing and functional treatments of textiles. There is growing awareness and readiness to adapt new perspective on industrial upgradation of Cleaner Production Programmed, such new technologies help enterprises achieve green production and cost reduction at the same time. Green Production has become necessary for enterprises under the upgrade and transformation policy. Therefore there is an urgent need to promote new technologies in textile dyeing and finishing, injecting new thoughts to the industry.

Figure 2.3.water free technology

2.1.4 Electrochemical Process Technology

Electrochemistry refers to the use of electrical energy in initiating chemical reactions, replacing traditional aid agents in direct chemical reactions. Taking Sulphur dyes as example, in traditional technology, sulphide(such as sodium sulphide, Na_2S) are used as reducing agents. Although reduction process is fast and direct, large amount of chemical energy is wasted and wastewater with high chemical oxygen demand (COD) value is produced, making long-term operation inefficient. If direct electrochemical reduction is adopted, no reducing agents are needed and the COD value of wastewater can be largely reduced, hence lowering the cost of wastewater treatment. Direct electrochemical reduction is undoubtedly more efficient than the traditional technology, and the underlying chemical principle is also simple. However, as the stability and oxidizing/reducing power of different chemical substances are not the same, dyes may not be directly and effectively reduced by electrodes.

2.1.5 Supercritical Fluid Dyeing Technology

Supercritical fluid refers to the phase of a substance with both temperature and pressure higher than the critical point (the point where liquid and gaseous phases of a substance become indistinguishable). This phase of a substance enjoys many advantages and can replace water in the dyeing process. In traditional water-dyeing technology, textiles should undergo multiple processes with the help of aid agents, chemical salts, surfactants and reduction clearing agents. In contrast, for the supercritical waterless dyeing technology, only supercritical fluid is needed for dyeing and circulation, after which the pressure and temperature can be lowered and the whole process is finished, without producing any waste water.

figure 2.4.Supercritical Fluid Dyeing Technology

2.1.6 Plasma Treatment Technology

When a substance in its gaseous phase absorbs enough energy, the outermost electrons in the atoms will escape the nucleus control and become free electrons, while the atoms become positively charged. This chemical status of a substance is called **plasma**.

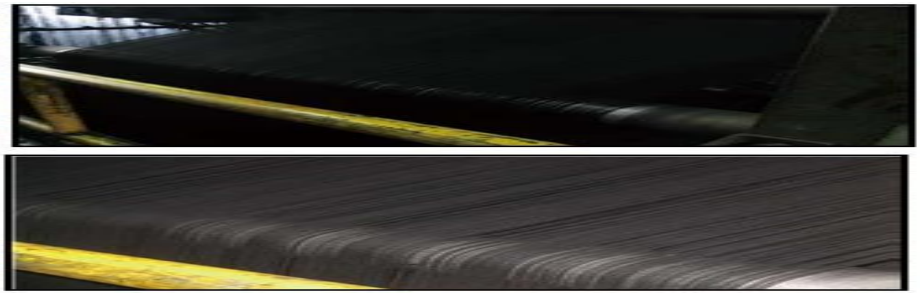


Figure 2.5. Plasma Treatment Technology

2.1.7 Significance of textile dye

When you look around, most of the fabric is either dyed or printed. Be it the clothes you wear on a daily basis or the upholstery at home, everything has a splash of colour and print on it. Dyeing and printing is known to be an ancient technique of enhancing the look of a fabric. As dyeing and printing is considered a beautiful art of surface ornamentation, it is predominantly taught in most fashion designing institutes**.** Today, some of the most renowned fashion designers have reflected the ancient art of dyeing and printing in their collection.

Figure 2.6. Significance of textile dye

2.2 Dyeing environmental effects and its significance.

Synthetic dyestuffs have introduced a broad range of colorfastness and bright hues. Nonetheless, their toxic character has become a reason of serious concern to the environment. Usage of synthetic dyestuffs has adverse impacts on all forms of life. Existence of naphthol,

vat dyestuffs, nitrates, acetic acid, soaping chemicals, enzymatic substrates, chromium-based materials, and heavy metals as well as other dyeing auxiliaries, makes the textile dyeing water effluent extremely toxic.

Figure 2.7. Textile dye and environmental effect

2.3 Interaction of dyes

Synthetic dyes almost have their origin from coal tar that leads to the formation of harmful atmospheric gases. Several synthetic colorants have been banned because they cause allergic effects. Natural dyes are derived from naturally occurring sources such as plants, insects, animals, and minerals. Natural dyes are generally ecofriendly and can provide a wide range of beautiful shades with acceptable levels of color fastness. A number of commercial dyes and textiles mills/plants started looking at the possibilities of using natural dyes to overcome environmental pollution caused by synthetic dyes. Various reports have been appeared on the behavior and applications of the natural dyes on textiles. Surfactants containing both hydrophilic and hydrophobic moieties are extensively used in our daily life and also in various industrial processes such as textiles, pulp, and paper industry. The use of water as a medium for textile processing ideally requires liquid that wets the fiber surface quickly and uniformly and here surfactants play a useful role because these can be used as leveling, dispersing, and wetting agents. Surfactants are required for level dyeing and so on. The surfactants act mostly in two ways, either they can form a complex with ionic dyes or they can be adsorbed into the fiber. Surfactant-dye associations are important in various dyeing process such as textiles dyeing, photography, and pharmaceuticals processes.

The studies on the interaction between natural dyes and surfactants are important and interesting for improving the dyeing process from theoretical, technological, ecological, and economical points of view. However, not much attention has been made on the interaction between natural dyes and surfactants.

Figure2.8. Interaction of natural dye

2.4 Interaction of chemicals

An additive effect of a chemical interaction occurs when two or more chemicals combine and produce a chemical with a total effect equal to the sum of the effects of each individual chemical in the reaction. The chemical interaction of atomic hydrogen with the first wall is not only interesting with respect to a possible contamination of the plasma via desorption of hydrogenated species from the wall materials and the impurities contained therein, but also with respect to possible getter effects which may affect the tritium inventory.

2.5 Chemicals and auxiliary's textiles.

Different classes of dyes are used for coloring different textile materials with the aid of auxiliaries, which facilitate the homogenization of the mixtures

Dyes, chemicals & auxiliaries' properties & functions

2.5.1 Dye classification

The term dyes are molecules that absorb and reflect light at specific wavelengths to give human eyes the sense of color. Dyes are used for coloring the fabrics Based on its originality there are two major types of dyes natural and synthetic dyes. Natural dyes are extracted from natural substances such as plants, animals, or minerals.

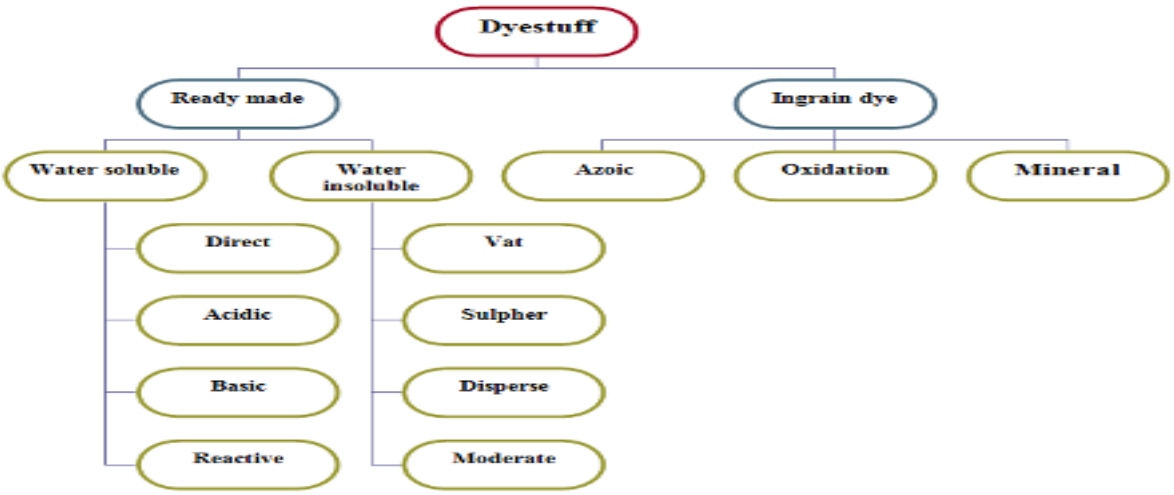


Figure 2.9. dye classification

2.5.2 Direct Dyes

Direct dyes are a relatively inexpensive and easy way of dyeing natural cellulose fibers like cotton and regenerated cellulose fibers like viscose and rayon. Although they do not have good fastness to washing or other wet processes. Hydrogen bonding and Van der Woals forces help bind the dye to the fiber. Fastness properties may be improved by after treatment-a post dyeing chemicals.

Apparatus and Chemicals

Apparatus: atmospheric dyeing machine, Beakers

Chemicals: Direct dyes, sodium chloride, sodium phosphate, leveling agent, and copper-Sulphate, acetic acid (30%). Dyeing Recipe

	MLR: 1:30
Chemicals used	Test 1
Direct dye (% o.w.f.)	1
Sodium carbonate (g)	1
Leveling agent (g)	0.5
Sodium chloride (g)	10
Water (L)	1

Recipe used to treat the dyed fabric:

Copper-Sulphate 0.5 g

Acetic acid (30%) 0.5g

MLR 1:30

Liquor Volume 1L Procedure:

Sample & dyeing soln Preparation ⟶ dyeing ⟶ rinsing treatment ⟶ Rinsing ⟶ drying

Preparation of dyeing solution:

Dissolve sodium phosphate in 1Lt of water. Then direct dye is made in to paste with small quantity of the water. Add residual water in the paste to dissolve the dye completely. Finally, leveling agent is dissolved in the dye solution.

Preparation of pretreatment solution:

Acetic acid is added in1L water. The copper sulphide is dissolved in the water completely.

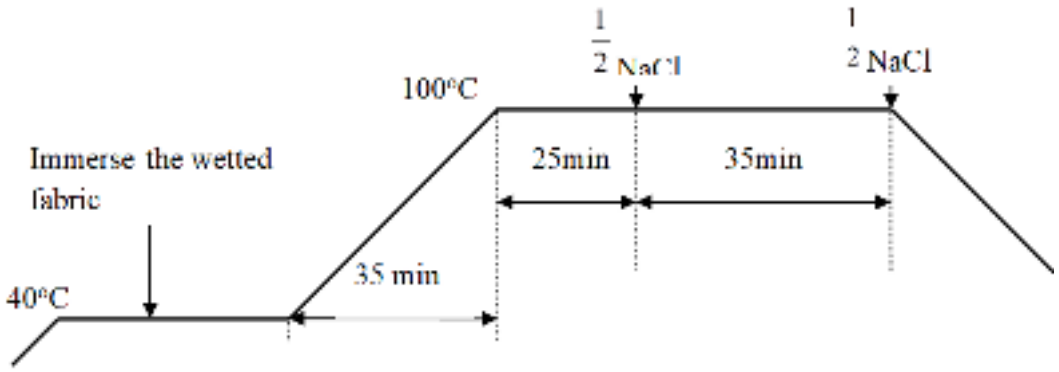


Figure 2.10. Direct dyeing cycles

2.5.3 Reactive Dyes

Reactive dyes from strong Covalent bonds with cellulosic fibers like cotton and regenerated cellulosic fiber like viscose, rayon. The formation of the covalent bond between dye and fiber means reactive dyes give extremely high wash and wet fastness properties. Apparatus and chemicals: Jigger, beaker, measuring cup.Reactive dyes, sodium chloride, sodium carbonate, soap powder.

- Dyeing Recipe

	MLR: 1:5
Chemicals used	Test 1
Reactive dye (% o.w.f.)	1
Sodium chloride (g)	20
Sodium carbonate (g)	15
Water(l)	1

Procedure:

Winding → Dyeing → Fixation → Washing → Soaping → Washing → Drying

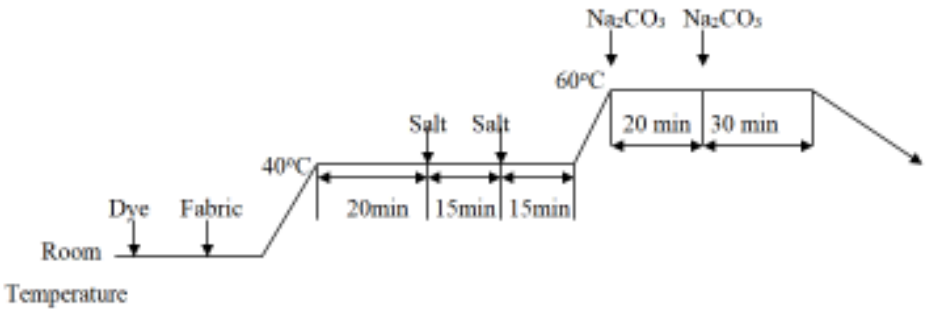


Figure 2.11. Reactive Dyeing Cycle using jig

2.5.4 Vat Dyes

Vat dyes are used to dye cotton and viscose, rayon. Vat dyes are insoluble and so cannot penetrate the fibers in solution. They can however be reduced to a soluble form called the leuco form in the presence of alkali and a reducing agent. Vat dyeing is a multistage process. The leuco molecules are then oxidized to be insoluble once more and develop the color inside the fiber. Vat dyes have excellent wash fastness properties but the color range is more limited and more expensive. Sulphur dyes are similar to vat dyes but are cheaper, less environmentally friendly and are limited to flat dull colors.

2.5.5 Azoic Dyes

Azoic dyes are applied to cotton and viscose, rayon. The textile is impregnated with a naphthol based, coupling compound and immersed in a dye bath containing a diazotized base triggering a precipitation reaction. The color is manufactured inside the fiber by the coupling of the two components. Since the dye molecules are large and insoluble, they have excellent wash fastness

properties. Poor rub fastness can be a problem due to dye formation on the textile surface. Insufficient after washing will give poor fastness to wet treatments.

2.5.6 Acid Dyes

Acid dyes have a direct affinity for protein fibers and are the main class of dyestuff for dyeing wool. Nylon also has an affinity for acid dyes. The attraction between dye and fiber is the result of negatively charged dye particles called anions associating with positively charged basic groups in the fiber generally under acid conditions.

2.5.7 Disperse Dyes

Disperse dye are applied to Polyester. Polyester has a lightly packed molecular structure called a crystalline structure. It is hydrophobic or water heating. Heat opens up the crystalline structure to allow disperse dye molecules to enter the fiber from solution where they have been held in suspension. The dye is trapped in the fiber upon cooling and held by physical forces to produce good fastness properties. Disperse dyes may be applied at elevated temperatures from pressurized vessels or at the boil with the assistance of a chemical called a carrier.

2.5.8 Basic Dyes

Acrylic fibers are dyed with the brilliant and intense modified basic dyes. Basic dyes are positively charged or cationic. These positively charged cations are attracted to negatively charged anions in the acrylic fiber. The reaction of the cation and anion form salt linkages and the fiber is colored with good wash and light fastness properties.

2.5.9 Dyestuff

Dyestuff is an organic or inorganic substance which can absorb light & reflect some lights to show color and which are water soluble

Exhaustion: movement of dye molecule from dye bath to surface of the fabric

Fixation: ability of adhere of dye inside the fiber

Fastness: resistance to fading due to washing, light, rubbing and etc.

Substantively: the attraction between dye and fiber under given dye concentration

Affinity: ability of dye to move from solution phase to fiber phase

Diffusion: penetration ability of dye through the pores of fiber

Adsorption: transfer of dye from aqueous solution to the fiber surface

Absorption: both adsorption and penetration ability

PH: chemistry the measure of the acidity or basic of an aqueous solution. Solution with a ph less than has a raised to be acidic and Solution with PH greater than 7are basic or alkaline .pure water has PH of very close to7

Temperature: a condition which tells us how cool or hot the given substance or work environment

Time: it is a duration or period which is taken when we apply or do something

2.5.10 Chemicals & auxiliaries' properties & functions

Textile auxiliaries are defined as chemicals of formulated chemical products which enables a processing operation in preparation, dyeing, printing of finishing to be carried out more effectively or which is essential if a given effect is to be obtained. The major uses of dyes are in coloration of textile fibers and paper.

The important auxiliaries used in dyeing can be broadly grouped into the following classes:- Wetting and penetrating agents. Its function Wetting and Penetrating Agents

a) Wetting agents are added to the dye bath to ensure that the entering goods are thoroughly and uniformly wetted with the dye solution.

(b) Dispersing agents. The function of a dispersing agent is to prevent agglomeration of individual dye particles during dyeing. Dispersing agents enhance the dispersion and ensure a fine particle size.

(c) Levelling agents. The levelness of a dyeing is generally governed by two properties of the dye.

(a) The exhaustion behaviour

(b) The levelling out capacity (migration power)

- One of the important objectives in dyeing is to secure level or uniform dyeing.

Many dyestuffs have a high initial rate of dyeing and show a tendency to rush on to the Fibre, causing uneven dyeing.

Table 2.1. Textile chemical and its uses

Chemicals	**Uses**
Stabilizer	Stable caustic soda and hydrogen per oxide reaction
Wetting agent	Improve the fabric wet ability
Hydrogen per oxide	Remove natural coloring materials for bleaching process
Sequestering agent	Convert hard water into soft water
Leveling agent	Level the shade of the dyestuff uniformly
Per oxide killer	Remove hydrogen per oxide residuals from the fabric surface
Acetic acid	Adjust the PH of the liquor
Salt	Used to penetration or exhaustion
soda ash	Used to fixation for color
Caustic soda	For deep dark shade
Soap	Remove un fixed chemicals and dye stuff
Softener	Used to soften and smoothen the fabric
Water:	Dyeing media

Self-check-2

Instruction I: write if the statement is correct say true or if the given statement is not correct say false

1. Dyeing is a process of imparting color to the fabric and increase the aesthetic value of it.(2 marks)

2. Direct dyes is water insoluble dye by its nature.(2 marks)

Instruction II: choose the best answer from the following alternative.

1. Which dyes have direct affinity for protein fibers and are the main class of dyestuff for dyeing wool?

A/ reactive B/ basic, C/acid, D/ direct

2. Among the following one is characteristics of poor wash fastness?

A/reactive B/ basic, C/acid, D/ directive

Instruction III: give your short Answer for the following questions. You are provided 4 minute for each question.

1. List at least three water insoluble dyestuff? (4marks
2. List at least three water soluble dyestuff?(5marks)

Operation sheet 2 title:

Operation Sheet 2	
Operation Title	**Dyeing process**
Purpose	To to improve the skill of deing process
Instruction	By using the given chemicals recipe which is found in procedure the dyeing operation.
Tools, Equipment and Materials	Weighing balance,Gray fabric, Ruler,Pencil/pen/marker,Record book/Agenda,Meter,Spoon ,Beaker,Stirrer,Thermometer,PH indicator/litmus paper,Oven dryer,Stove and Cutter
Precautions	→ Follow the correct procedure/steps in listed bellow. → 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 bellow “A”correctly
Conditions or situations for the operation	→ The practical class room (dyeing 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	→ Light fastnes , washing fastness, staining test.

Procedure, "A" Step1, Fabric is wetted with water and wound around the sample holder in loose form.

Step2, Add dyeing solution in the beaker of atmospheric sample dyeing and heat the solution and start dyeing.

Step3,After dyeing has been carried out at 40oc for 20 min, half of sodium chloride dissolved with 100ml water is added in the beaker, and the remaining sodium chloride is added after 35 min of dyeing time.

Step4,After 15 min, the temperature of the dye bath is elevated up to 60^{o}c, and then half of sodium carbonate dissolved with 100 ml water is added in the beaker. After 20 min the remaining sodium carbonate is added.

LAP Test

Task 1: prepare 10cm*10cm treated fabric

Task2: weigh it

Task3: prepare reactive dye recipe ad ready the stove/on/

Task4:add the prepared recipe, mix fabric with beaker and apply reactive dye.

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers.

Unit Three: Dyeing machine

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

- Weigh of textile materials
- Dye worksheet
- Dyes, chemicals and auxiliaries
- Non-conforming materials.
- Dyeing machine
- Monitor dyeing operations
- Identify, correct and report major and minor faults

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:

- Set up and load machine
- Weighing and loading textile materials
- Measuring & mixing dye
- Checking dye worksheet
- Loading precisely dyes, chemicals and auxiliaries
- Reporting non-conforming materials.
- Operate and monitor dyeing machine
- Operating dyeing machine
- Monitoring dyeing operations
- Identifying, correcting and reporting major and minor faults

NB Unit Three and Four is merged in to Unit three as dyeing machine

3.1 Weigh textile materials

Fabric, dyestuff, auxiliaries… weight is a way to measure different textiles materials, like dyestuff, oxides, salts, carbonates, cotton, silk, polyester, and canvas. This measurement is determined by the. thickness of the threads that make up the material. Most fabric items will fall into one of these categories: Light weight fabrics

Figure 3.1. Weigh textile materials

3.1.1 Load textile materials

Loading and storing chemical and auxiliary products is the beginning of the production chain. By controlling it we can monitor the level of product consumption, make predictions and have an exact control of the product in real time. This will lead to forecasting in order to optimize supply purchases, re-negotiate prices with suppliers, based on the volume of production, and control the use of the right quantities of raw materials for the treatment of the fabric, drastically reducing the level of waste.

Figure 3.2. Load textile material

3.2 Measure fabric dye

In textile dyeing application one has to produce consistent lots of dyeing. Colour measurement technique helps us to quantify colour in terms of numerical values to decide mass liquid ratio and

recipe calculation to perform the perfect activity on shad and uniformity of dyeing fabric. The need for a numerical pass/fail program arises from the fact that visual evaluations of shade difference are not consistent when establishing the fine line between acceptable and unacceptable dyeing.

3.2.1 Recipe calculation

Recipe calculation means finding out of the amount of dye staff, chemicals and ingredients which is given in the recipe/ dye work sheet to mix the dye for carrying out of dying process.

Table: 3.1. Recipe of dyeing with reactive dye

	MLR :1:30 TMP:90$^{O}_{C}$ Time: 1 hour PH: 11-12
Chemical used	
direct dye[OWF]	6%
Salt	5 gm./l
soda ash	0.5gm/l
Water	O.W.F
Wetting agent	2.0 g/L
Sequestering agent	1.0 g/l
Leveling agent	0.5 g/l
Fabric weight	450 gram

3.2.2 Mixing fabric dye

We often focus on how to improve efficiency in textile plants regarding product distribution and preparation. In addition, we also often work with ready-made chemicals in the textile plant. Their correct handling and storage also represent a challenge to be efficient and respect all safety measures. In textile industry it is vital to work with chemicals and auxiliaries for the treatment of the fabric and the textile finishing. Most of these products usually arrive through an external

supplier for on-site storage. If we look after this part of the production process as well, it will mean an advance in cost savings and investment in safety.

Figure 3.4. Mixing dye

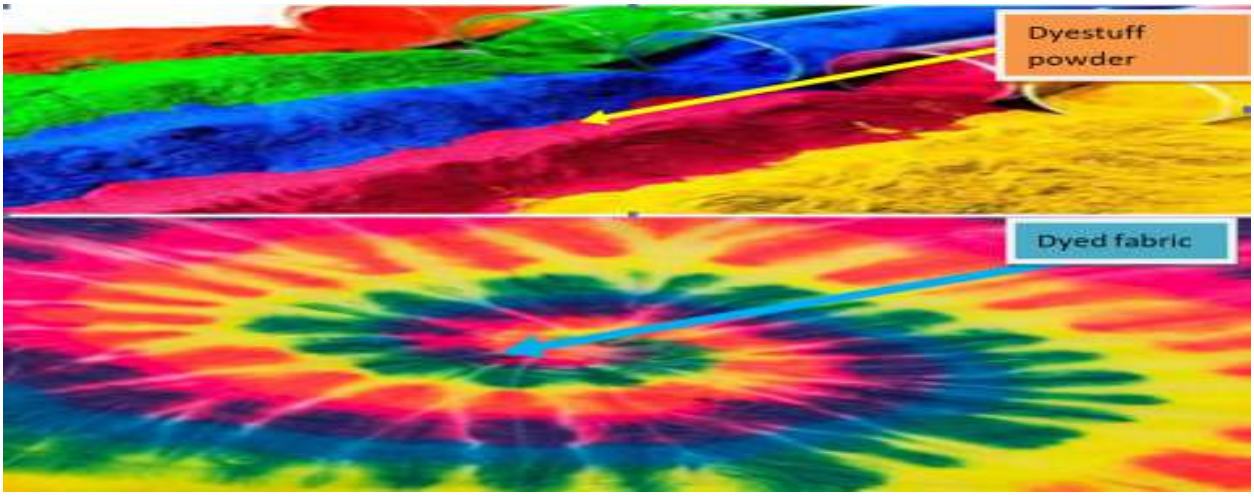


Figure 3.5. Tie dye

3.3 Checking dye worksheet

Dyeing in textile is the process of coloration to textile materials like fibers, yarns, and fabrics. In this process different types of dyes and chemicals are used to produce different shades at different types of fabric. This process can be done by hand or by machine. Various types of dyeing recipe are used for different types of fiber. In this article 6 typical recipes have been given for different dyes and fibers.

- Typical recipe for dyeing of cotton by direct dye:

Direct dye ----------X%

Salt (NaCl) ----------5.0-20.0 g/L

Soda ash (Na_2CO_3) ----------1.0-5.0 g/L

Wetting agent ----------1.0-2.0 g/L

Sequestering agent ----------1.0-2.0 g/L

Leveling agent ----------0.5-1.0 g/L

M. L. R. ----------1:5 – 1:10

PH ---------- neutral to slight alkaline

Temperature ----------90-100^{0}C

Time ---------- 50-60 min

- Dyeing of cotton with vat dye typical recipe

Vat dyes ---------- X g/L

Wetting agent ---------- 0.5-1 g/L

Sequestering agent ---------- 1.0-2.0 g/L

Dispersing agent ---------- Y g/L

Caustic soda (66-70^{0}Tw) ----------15-30 g/L

Hydroze ---------- 10-20 g/L

Recipe for Oxidation:

Hydrogen peroxide ----------0.2-1.0 g/L

Temperature ---------- 25-60^{0}C

3.4 Load dyes, chemicals and auxiliaries

Prepare the recipe ,dyeing chemicals auxilariy and load to the dyeing machine.

Figure 3.6. Load dyes, chemicals and auxiliaries

3.5 Reporting non-conforming materials

A Non-Conforming Material Report or NCMR is the standard way to report a material that does not meet the predetermined specifications identified during an inspection. This inspection can occur during receiving, manufacturing, in-process, or final inspection. The report should have a detailed description of the non-conformance, the amount of material affected, and the action taken to resolve.

the issue. An NCMR can be escalated to create a SCAR (Supplier Corrective Action Request) if the non-conforming material is received from a supplier.

3.6 Types of dyeing machines according to textile material

Fiber dyeing machine

Fabric dyeing machine

Yarn dyeing machine

Garment dyeing machine

A. Fiber dyeing machine

Conical pan loose stock dyeing machine

Annual case for loose stock dyeing machine

Hussong loose cotton dyeing machine

Jagen barg dyeing machine

Simplex dyeing machine

Dreze dyeing machine

Ober maier dyeing machine

Long close loose cotton dyeing machine

B. Yarn dyeing machine

a. Hank form:

Hussong hank dyeing machine

Pulsatur hank dyeing machine

G.H.S. hank dyeing machine

Clauder Weldon hank dyeing machine

b. Package form:

Cop dyeing machine

Cheese dyeing machine

Warp dyeing machine

3.7 Dyeing machine

figure 3.7. dyeing machine and operation

- **Jig dyeing** is an effective technique for dyeing woven fabrics in open width to avoid creasing problems. A bath of fabric of one roller is gradually unwound and passes through a dye bath of relatively low volume.

Figure 3.8.Jig machine

- **Winch** dyeing machines are low cost design that is a simple to operate and maintain, yet versatile in application providing invaluable for preparation, washing or after treatments as well as the dyeing stage itself.

figure3.9.winch machine

3.8 . Monitoring dyeing operations

Dyeing operations are used at various stages of production to add color and intricacy to textiles and increase product value. Most dyeing is performed either by the finishing division of vertically integrated textile companies or by specialty dye houses.

Figure 3.10. Monitoring dyeing operations

Textiles are dyed using a wide range of dyestuffs, techniques, and equipment. Dyes used by the textile industry are largely synthetic, typically derived from coal tar and petroleum-based intermediates.

Dye fixation on the fiber occurs much more rapidly in continuous dying than in batch dyeing.

Each dyeing process requires different amounts of dye per unit of fabric to be dyed. This is significant since color and salts in wastewater from spent dyes are often a pollution concern for textile facilities. In addition, less dye used results in energy conservation and chemical savings. The amounts of dye used to depend on the dye are exhausted from the dyebaths which determine the required dyebath ratio.

3.9 Identify, correct and report major and minor faults

The guide line to confirming and non-confirming of materials is customer's specification. During dyeing a number of defects occur. These defects are classified into two main categories:

1. Major Defects
2. Minor Defects

3.9.1 Major Defect

A defect, if conspicuous on the finished product, would cause the item to be a second. (A "second" is a garment with a conspicuous defect that affects the salability or serviceability of the item.

3.9.2 Minor Defect

A defect is defined as minor defect that is not likely to reduce the usability of the product, but nevertheless may negatively influence the sales. The minor defects can be untrimmed thread-ends, slight dirt in a non-noticeable zone which can be removed, etc.

3.10 Causes of Dyeing Defects

3.10.1 Due to Material:

- Material having dead fibers or other defective fibers.
- Left over of Chemicals after bleaching etc.
- Material not properly de-sized.
- Material not properly mercerized.
- Absorbency of the fabric not proper.
- Sticking of insoluble material on the fibers.
- Impurities are not removed properly, and Uneven heat treatment.

3.10.2 Due to Water Quality:

- More Hardness of water
- Water has metal ions such as iron.
- pH of water not proper
- Water having more chlorine

3.10.3 Due to Improper Dye Solution:

- Improper weight ratio of colors, material and chemicals
- Improper material to water ratio and improper filtering colors

Self -check-3

Instruction I: write if the statement is correct say true or if the given statement is not correct say false

1. Dyeing stage is processed only in dyeing and fabric.(2 marks)
2. Fabric dyes always is not comfortable in direct dye .(2 marks**)**

Instruction II: choose the best answer from the following alternative.

1. Which type of dye is water soluble?

A/ dsperse dye B/ vate dye, C/direct dye, D/ pigment

2. Among the following one is poor wash fastness?

A/reactive dye B/ basic dye, C/acid dye, D/ direct dye

Instruction III: give your short Answer for the following questions. You are provided 4 minute for each question.

1. Write at list three dyeing faults?(4marks
2. List at least two dyeing machine?(4marks)
3. Types of dyeing machines according to textile material?(3)

Operation Sheet 3	
Operation Title	**Dyeing machine**
Purpose	To understand the skill of operating dyeing macine
Instruction	By using the given chemicals recipe which is found in procedure the dyeing machine operation.
Tools, Equipment and Materials	Weighing balance,Gray fabric, Ruler,Pencil/pen/marker,Record book/Agenda,Meter,Spoon ,Beaker,Stirrer,Thermometer,PH indicator/litmus paper,Oven dryer,Stove and Cutter
Precautions	→ Follow the correct procedure/steps in listed bellow. → Perform the given operation based on the operational requirement including by applying standard occupational health and safety rule.
Procedures in	→ Review the procedure and learning guide manual → Identify necessary equipment & tools

doing the task	→ Follow the procedure which is found bellow "B"correctly
Conditions or situations for the operation	→ The practical class room (dyeing 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	→ Light fastnes , washing fastness, staining test.

Procedure"B"

Step1. prepare or cut 15cm*15cm wet treatd cotton fabric

Step2, weigh the prepared cotton wet treated fabric

Step3, Add dyeing solution in the beaker of atmospheric sample dyeing and heat the solution and start dyeing.

Step4,After dyeing has been carried out at 40oc for 20 min, half of sodium chloride dissolved with 100ml water is added in the beaker, and the remaining sodium chloride is added after 35 min of dyeing time.

Step5,After 15 min, the temperature of the dye bath is elevated up to 60^{o}c, and then half of sodium carbonate dissolved with 100 ml water is added in the beaker. After 20 min the remaining sodium carbonate is added.

LAP Test

Task 1: weigh 10cm*10cm treated fabric

Task2: calculate the mass per liquid ratio (MLR)

Task3: prepare reactive dye recipe ad ready the stove/on/

Task4: add the prepared recipe, mix fabric with beaker and apply reactive dye.

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

Unit Four: Dyeing operations

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

- Un-load textile materials
- Dispatch Product
- records and documentation

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:

- Un-load textile materials
- Dispatch Product
- Production records and documentation

4.1 Unload textile materials

Unload means removing the product from the machine, truck or cargo. Unload of goods is often required when the goods are delivered to the customer. When the goods are bulky and complex, poor handling of the goods can often cause damage to the goods and hence this task is often outsourced to the transporting facilities by the companies.

figur 4.1. Unload textile materials

Textiles can be made from many materials. These materials come from four main sources: animal (wool, silk), plant (cotton, flax, jute), mineral (asbestos, glass fibre), and synthetic (nylon, polyester, acrylic). In the past, all textiles were made from natural fibres, including plant, animal, and mineral sources. A textile or cloth is a flexible woven material consisting of a network of natural or artificial fibres often referred to as thread or yarn. Yarn is produced by spinning raw fibres of wool, flax, cotton, or other material to produce long strands. Natural fabrics are derived

from the fibres of animal coats, plant seeds, stems and leaves, and silkworm cocoons. It is stress resistant, bio-degradable and buoyant.

4.2 Dispatch Product

Dispatch is a procedure for assigning employees (workers) or vehicles to customers for send an output or product to the next processor from store/industry to whole seller, retailer, and customer.

Figure 4.2.pispatch product

4.3 . Records and documentation

A document is a piece of writing that contains information whereas a record is a document that can be used as evidence. Both documents and records provide information, but records also serve as evidence. Documentation is essential to the advancement of research, teaching and learning, and also to capture our cultural memory and preserve the human record for future generation. There are three methods to document, i.e. Textual, Visual and Audio Visual documentation which can be in multiple formats and are usually used in conjunction. The choice of methods in which work is documented is up to the discretion of the conservator based on the object on that work is going on.

Figure 4.3.Records and documentation

Self-check 4

Instruction I: write if the statement is correct say true or if the given statement is not correct say false

1. Dyeing is a process of imparting color to the only the design fabric and increase the aesthetic value of it.(2 marks)
2. Dyeing activity is done only in fabric and yarn stage by its nature.(2 marks**)**

Instruction II. choose the best answer from the following alternative.

1. From the following one is different from others of textile material for dyeing wool?

A/ cotton, B/ acrylic C/wool, D/ wetting agent

2. Among the following one is not necessary for dyeing operation?

A/unloading product B/ dispatch the product, C/record, D/ direct

Instruction III: give your short Answer for the following questions. You are provided 4 minute for each question.

1. Define the term documentation? (4marks
2. List at least three plant fiber for textile material?(5marks)

Operation Sheet4	
Operation Title	Dyeing operation
Purpose	To operate dyeing perfectly.
Instruction	By using the given chemicals recipe which is found in procedure the dyeing machine operation.
Tools, Equipment and Materials	Weighing balance,Gray fabric, Ruler,Pencil/pen/marker,Record book/Agenda,Meter,Spoon ,Beaker,Stirrer,Thermometer,PH indicator/litmus paper,Oven dryer,Stove and Cutter
Precautions	→ Follow the correct procedure/steps listed below. → Perform the given operation based on the operational requirement including by applying standard occupational health and safety rule.
Procedures in doing the task	→ Review the procedure and learning guide manual → Identify necessary equipment & tools → Follow the procedure which is found bellow “C”correctly

Conditions or situations for the operation	→ The practical class room (dyeing 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	→ Light fastnes , washing fastness, staining test.

Procedure "C"

Step1:Fabric is wetted with water and wound around the sample holder in loose form.

Step2:Add dyeing solution in the beaker of atmospheric sample dyeing and heat the solution and start dyeing.

Step3:After dyeing has been carried out at 40oc for 20 min, half of sodium chloride dissolved with 100ml water is added in the beaker, and the remaining sodium chloride is added after 35 min of dyeing time.

Step4:After 15 min, the temperature of the dye bath is elevated up to 60^{o}c, and then half of sodium carbonate dissolved with 100 ml water is added in the beaker. After 20 min the remaining sodium carbonate is added.

LAP Test4

Task 1: prepare 10cm*10cm treated fabric

Task2: weigh it

Task3: prepare reactive dye recipe ad ready the stove/on/

Task4: add the prepared recipe, mix fabric with beaker and apply reactive dye.

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

Unit Five: Dye outcomes
This unit is developed to provide you the necessary information regarding the following content coverage and topics: • Quality dyed textile materials • Dyed textile materials • Dyeing faults 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: • Understand quality of dyed textile materials • Assesses dyed textile materials • Rectify dyeing faults

5.1 Quality dyed textile materials

Conforming to specification is quality. Quality can also mean meeting or exceeding customer's expectation all the time. The customer expectation can be of different types. Then expectation of quality and the ability to distinguish various quality characteristics also vary of customer.

E.g. more educated customer's requirements are very specific and less educated customer's requirements for quality are less. Quality control is concerned with the evaluation of test data and its application to control of textile process, raw material, intermediate products and final products. It is concerned not only with the quality level and cost of maintaining this quality level but also concerned with presentation of tangible values to measure quality and changes in quality. In order to control quality one must know about the consumers expectation.

5.2 Assessing dyed textile materials

Most forms of textile materials can be dyed at almost any stage. Quality woolen goods are frequently dyed in the form of loose Fibre, but top dyeing or cheese dyeing is favored in treating worsteds. Manufacturers prefer piece dyeing, which allows stocking of white goods, reducing the risk of being overstocked with cloth dyed in colours that have not been ordered.

Figure 5.1. Quality dyed textile materials.

5.3 Dyeing Faults

Dyeing is the process of adding color to textile products like fibers, yarns, and fabrics. Fabric that has had a poor preparation history will invariable give problems during dyeing that may not be readily apparent as Dyeing Faults. Quality control procedures should be in place to ensure that preparation is correct, particularly in the case of fabric to be dyed continuously. Many known-unknown faults occur during dyeing operation.

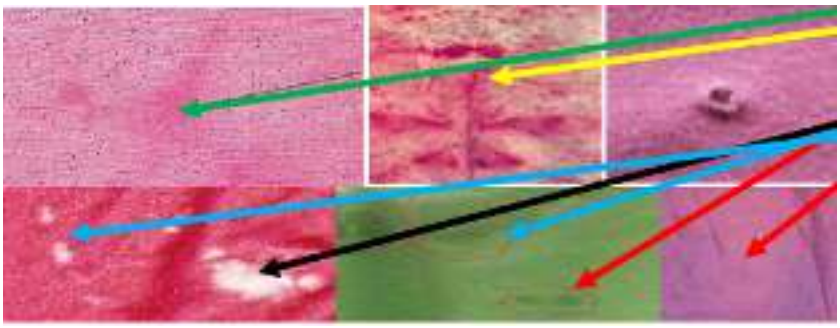


Figure5.1: Dyeing Faults

5.3.1 Crack, rope & crease marks:

Causes: Poor opening of the fabric rope, Shock cooling of synthetic material, Incorrect process procedure, higher fabric speed

Remedies: Pre-Heat setting, Lomer rate rising and cooling the temperature, reducing the m/c load

Higher liquor ratio, running at a slightly higher nozzle pressure

Fabric distortion and increase in width:

Causes: Too high material speed, Low liquor ratio

Remedies: By decreasing both nozzle pressure & winch speed

- **Pilling: Causes:** Too high mechanical stress on the surface of the fabric

Excess speed during processing, excess foam formation in the dye bath

Remedies: By using of a suitable chemical lubricant, by using anti-foaming agent

By turn reversing the Fabric before dyeing

Running problem: *A. Ballooning:*

Causes: Seam joining with too densely sewn

Remedies: By cutting a vertical slit of 10-15 cm in length for escaping the air.

B. Intensive foaming:

Causes: Pumping a mixture of air and water

Remedies: By using anti-foaming agent

5.3.2 Uneven/un level dyeing:

Causes: Uneven pretreatment (uneven bleaching & mercerizing), Uneven heat-setting in case of synthetic fibers, Quick addition of dyes and chemicals, Lack of control of dyeing m/c

Remedies: By ensuring even pretreatment, By ensuring even heat-setting in case of synthetic fibers, By slow addition of dyes and chemicals, Proper controlling of dyeing m/c and Shade variation.

5.3.3 Roll to Roll Variation or Meter to Meter Variation

Causes:Poor migration property of dyes.

- Improper dyes solubility.
- Hardness of water.
- Faulty m/c speed, e.t.c

Remedies: Use standard dyes and chemicals.

- Proper m/c speed.
- Use of soft water.

5.3.4 Crease Mark

Causes: Poor opening of the fabric rope

- Shock cooling of synthetic material
- If pump pressure & reel speed is not equal
- Due to high speed m/c running

Remedies: Maintaining proper reel sped & pump speed.

- Lower rate rising and cooling the temperature
- Reducing the m/c load
- Higher liquor ratio

5.3.5 Dye Spot

Causes: Improper Dissolving of dye particle in bath.

- Improper Dissolving of caustic soda particle in bath.

Remedies: By proper dissolving of dyes & chemicals

- By passing the dissolved dyestuff through a fine stainless steel mesh strainer, so that the large un-dissolved particles are removed.

5.3.6 Wrinkle Mark

Causes: Poor opening of the fabric rope

- Shock cooling of synthetic material
- High temperature entanglement of the fabric

Remedies Maintaining proper reel sped & pump speed.

- Lower rate rising and cooling the temperature
- Higher liquor ratio

5.3.7 Softener Mark

Causes:

- Improper mixing of the Softener.
- Improper running time of the fabric during application of softener.
- Entanglement of the fabric during application of softener

Remedies: Maintaining proper reel sped & pump speed.

- Proper Mixing of the softener before addition.
- Prevent the entanglement of the fabric during application of softener

Self-check-5

Instruction I write if the statement is correct say true or if the given statement is not correct say false

1. Fabric distortion is one among the dyeing faults..(2 marks)
2. level dyeing is occurred simply in nature.(2 marks**)**

Instruction II choose the best answer from the following alternative.

1. From the following one is different from others textile material for dyeing wool?

A/ Fabric distortion, B/ increase in width C/un even, D/ leveling dye

3. Among the following one is **not** dyeing fault?

A/ Crack, B/ rope, C/ crease marks, D/ level/even shading

Instruction III: give your short Answer for the following questions. You are provided 4 minute for each question.

1. Write three stage dyed textile materials? (4marks)
2. Write causes of wrinkle mark faults?(4marks)

Operation Sheet 5	
Operation Title	Dye outcome
Purpose	To to check the dye outcome
Instruction	By using the given chemicals recipe which is found in procedure the dye outcome.
Tools, Equipment and Materials	Weighing balance,Gray fabric, Ruler,Pencil/pen/marker,Record book/Agenda,Meter, ,Beaker,Stirrer,Thermometer,PH indicator/litmus paper,
Precautions	→ Measure dyeing faults at least three times before recording the result on the given format.
Procedures in doing the task	→ Review the result. → Check light fastness,washing fastness of dyed fabric
Conditions or situations for the operation	→ The practical class room (dyeing 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	→ Light fastnes , washing fastness, staining test, dyeing faults.

Step-1: lay the product on the table or in front of the light

Step-2: observe and assess the level of the product

Step-3: record the finding or result on the given format

Step-4: display the out come

Lap Test5

- Task-1: check the shade or uniformity of dyeing materials.
- Task-2: compare with the standard or given product and what you have to get finally.
- Task-3: list out dyeing faults and record it.

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