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TEXTILE WET PROCESSING

LEARNER GUIDE

National Vocational Certificate Level 3

Version 1 - November, 2019

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Introduction

Welcome to your Learner's Guide for the Textile Wet Processing (Dyeing Technologist) Level-3. It will help you to complete the program and to go on to complete further study or go straight into employment.

Textile Wet Processing (Dyeing Technologist) Level-3 program is to engage young people with a program of development that will provide them with the knowledge, skills and understanding to start this career in Pakistan. The program has been developed to address specific issues, such as the national, regional and local trends, markets, the manpower availability within the country, and meeting and exceeding the needs and expectations of their employers / customers.

The main elements of your learner's guide are:

- **Introduction:**
  - This includes a brief description of your guide and guidelines for you to use it effectively
- **Modules:**
  - The modules form the sections in your learner's guide
- **Learning Units:**
  - Learning Units are the main sections within each module
- **Learning outcomes**:
  - Learning outcomes of each learning units are taken from the curriculum document
- **Learning Elements:**
  - This is the main content of your learner's guide with detail of the knowledge and skills (practical activities, projects, assignments, practices etc.) you will require to achieve learning outcomes stated in the curriculum
  - This section will include examples, photographs and illustrations relating to each learning outcome
- **Summary of modules**:
  - This contains the summary of the modules that make up your learner's guide
- **Frequently asked questions**:
  - These have been added to provide further explanation and clarity on some of the difficult concepts and areas. This further helps you in preparing for your assessment.
- **Multiple choice questions for self-test**:

  These are provided as an exercise at the end of your learner's guide to help you in preparing for your assessment.

TEXTILE WET PROCESSING

Module-6

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Modules

Module 6: 0723001101 Carry out Exhaust Dyeing for Woven Fabrics.

Objective of the module: This competence standard covers the skills and knowledge required to perform the dyeing parameters for dyeing fabrics by the exhaustion process in accordance with the dyeing plan and to ensure color matching to the required quality standards.

Duration: 80 hours **Theory:** 16 hours **Practical:** 64 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Follow Dyeing Plan for woven fabric dyeing by exhaust process	**The trainee will be able to:** Receive RFD (Ready for Dyeing) fabric for exhaust dyeing according to program sheet. Receive shade standards for shade matching. Arrange material for dyeing process as per program sheet. Interpret specs for exhaust dyeing process.	Knowledge of processing of woven fabric ready for dyeing (RFD) used for dyeing at exhaust dyeing methods. Identifying shade required for the dyeing as per customer's order. Knowledge of methods of shade matching. Types of dyes, chemicals and auxiliaries used for exhaust dyeing for woven fabrics. Understanding the spec sheet / order sheet for processing the exhaust dyeing on woven fabrics.	Winch dyeing machine Jigger dyeing machine Jet dyeing machine Over lock machine Related Chemicals and dyes
LU2: **Prepare and ensure woven fabric dyeing parameters for exhaust dyeing**	**The trainee will be able to:** Instruct exhaust dyeing machine operators for dyeing process according to given parameters. Calculate amount of dyes and chemicals as per given in recipe for production as per dyeing plan. Execute dyes and chemical preparation for exhaust dyeing at production level.	Knowledge of dyeing parameters such as pH, temperature, TDS, liquor ratio, chemicals and auxiliaries used during woven fabric dyeing at exhaust dyeing process. Calculating skills for dyes and chemical calculations according to given recipe. Preparing dyes and chemicals and conversion knowledge from recipe level to the production level. Setting of machine parameters like speed, capacity, working principle, temperature control, productivity,	Winch dyeing machine Jigger dyeing machine Jet dyeing machine Over lock machine Iron Tape

	Set machine parameters for exhaust dyeing process. Verify process parameters for dyeing as per dyeing plan. Supervise safety precautions as per job requirement.	steam, air valve, water etc. Knowledge of machine speed and proper handling of machine according to the type of operations, fabrics and product type. Verifying all parameters for machine and dyeing process according to dyeing plan. Supervising and verifying the safety precautions required for dyeing operators before start of machine operations.	
LU3: **Identify shade by using shade matching method for woven fabrics**	**The trainee will be able to:** Verify shade standards for shade matching. Match shade as per standards and make corrections if required.	Knowledge of various methods used for shade matching like spectrophotometer and light box with understanding of standard pantone book. Knowledge of shade matching, variation and make correction if any.	Spectrophotometer Light Box Pantone Book Consistency cards for shade variation
LU4: Perform Dyeing	**The trainee will be able to:** Arrange material for dyeing process as program sheet. Execute production on set parameters according to program.	Operational knowledge of exhaust dyeing machine for woven fabric dyeing with required parameters like speed, capacity, working principle, temperature control, productivity, steam, air valve, water etc. Differentiating the dyeing process for woven dyeing at exhaust machines like winch, jigger and jet.	Winch dyeing machine Jigger dyeing machine Jet dyeing machine
LU5: **Verify quality of woven fabric dyeing by exhaust process**	**The trainee will be able to:** Verify quality parameters during production for matching with standards. Inspect physically dyeing process to maintain quality & in-time production. Take corrective actions for any issues concerned with quality	Verifying methods of quality parameters such as pH, temperature, TDS, liquor ratio, chemicals and auxiliaries used during woven fabric dyeing at exhaust dyeing process. Inspecting the dyeing process for maintaining quality and timely completion of process. Troubleshooting of issues concerned with quality of dyeing process at exhaust dyeing methods.	Light Box Iron Tape Pantone Book

	according to requirement.		
LU6: **Prepare production report for woven fabric dyeing by exhaust process**	**The trainee will be able to:** Verify production register maintain by machine operators shift-wise. Calculate and Record efficiency of every machine for evaluating machine production progress. Prepare shift production report. Prepare reports for faults occur during shift.	Importance of recording of machine and dyeing parameters like temperature variation, time consumption, fault detection, parts positions, chemicals and auxiliaries adding time during dyeing process etc on production register Calculating efficiency of every machine and evaluating operator's capacity for future settings for production. Advantages of recording the running and stoppage time of machine for calculating machine and operator's efficiency on production register. Verifying the shift production and evaluating faults occurs during shift for finding its causes and remedies in future dyeing plan.	Computer Calculator Telephone Printer Stationary

Exhaust Dyeing

Exhaust dyeing is one of the most popular dyeing methods. Most of the dyes could be used for exhaust dyeing of textile material. The exhaust dyeing process is used for staple fibre dyeing. Yarn and fabric could be dyed by exhaust dyeing method. Dye solution or dye bath is produced by dissolving the dyestuff according to required liquor ratio. Then Textile material is immersed in to the dye solution. Initially the surface of the fibre is dyed when dyes contact with the fibre, then the dyes are entered in the core of fibre. Proper temperature and time is maintained for diffusion and penetration of dyes molecule in the fibres core. During the process, kinetic and thermodynamic reactions interact.

Exhaustion

In exhaust dyeing, all the textile material contacts all the dye liquor and the fibres absorb the dyes. The concentration of the dye in the dye bath therefore gradually decreases. The degree of dyebath exhaustion as a function of time describes the rate and extent of the dyeing process. For a single dye, the exhaustion is defined as the mass of dye taken up by the material divided by the total initial mass of dye in the bath, but for a bath of constant volume:

$$\% \text{ Exhaustion} = \frac{C_0 - C_s}{C_0} \times 100$$

Where Co and Cs are the concentrations of dye in the dyebath initially and at some time during the process, respectively.

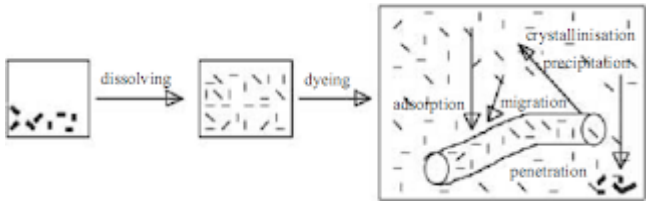
Dyeing Theory of exhaust dyeing:

The dyeing process is a chemical reaction occurring between the dye molecule and the fibre molecule:

$$\text{Dye(s)} + \text{Fibre} \underset{V-1}{\overset{V1}{\rightleftharpoons}} \text{Dye - Fibre}$$

The kinetics (process speed) and thermodynamic (balance) relationships both could be examined to evaluate the dyeing process.

Application of kinetics and thermodynamics to exhaust dyeing process:
When the textile material is immersed in to the disperse dye solution, a complex bio-chemical reaction is occurred between the dyes molecule and fibers. The exhaust dyeing process is carried out at particular process stages.



To gain the proper knowledge of the exhaust dyeing theory, it is fundamental to divide it into various stages (even if sometimes there is a time overlapping) and learn each of them individually from different points of view:
-Kinetics of dyeing (study of the reaction rate or speed).
-Thermodynamics (study of balance of reaction).
Hydrokinetics (influence on kinetics of the liquor and/or material turbulence, depending on the dyeing machine used). This is an important aspect not only for exhaust dyeing.

Steps involve with Exhaust Dyeing:
1. First stage (dissolving and dispersion of the dye)
2. Second stage (adsorption)
3. Third stage (Diffusion)

4. Fourth stage (migration)

Source: http://dyes4dyeing.blogspot.com/2012/06/exhaust-dyeing.html

Ready for Dyeing (RFD) Definition

Understanding the Term

A RFD fabric refers to a white fabric that was processed through scouring and bleaching to remove starches, sizing or finishes applied to the fabric which could interfere with the dyeing. Scouring is done to improve dye uptake and absorption into the fabric and improve evenness in dyeing throughout the fabric length.

Application

Manufacturing factories use RFD fabrics as a base for dying or printing on finished goods.

RFD fabrics are created by processing Greige fabrics.

Illustration

Dyeing Auxiliaries | Classification of Dyeing Auxiliaries According to Function

Dyeing Auxiliaries:

Dyeing auxiliaries mean a chemical or formulated chemical product which enables a processing operation in preparation, dyeing, printing or finishing to be carried out more effectively, or which is essential if a given effect is to be obtained. Main functions of dyeing auxiliaries to prepare the substrate for coloration, to stabilize the application medium, to increase the fastness properties of dyeing, to modify the substrates etc. In this article I will give a list of dyeing auxiliaries and explain some important auxiliaries function in dyeing.

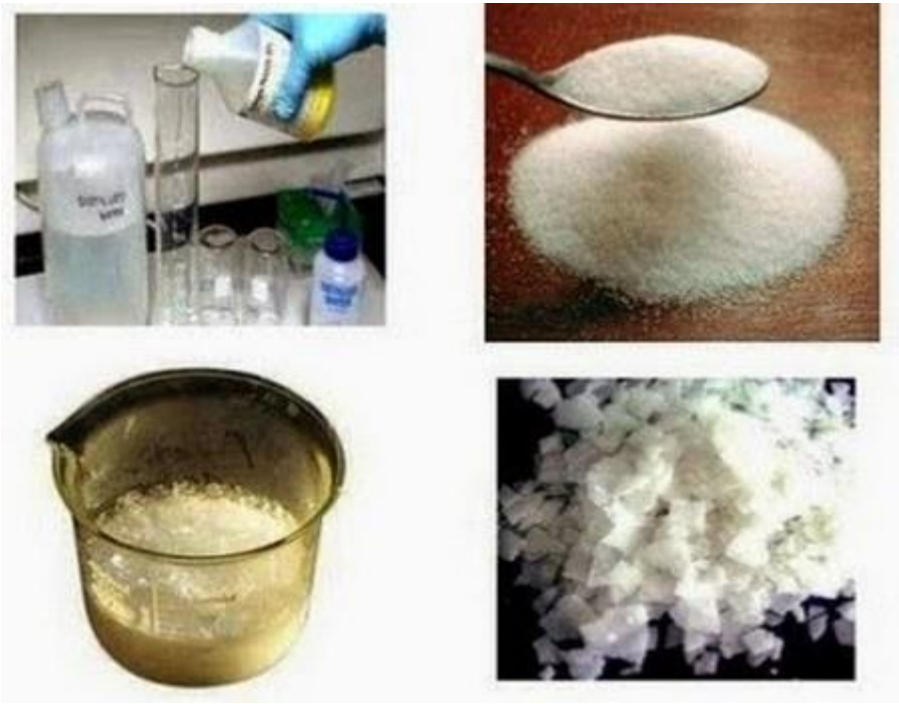


Fig: Dyeing auxiliaries

Classification of Dyeing Auxiliaries According to Function:

1. Sequestering agent
2. Lubricants / Anti-creasing.
3. Pretreatment Chemicals
4. Peroxide killer
5. Leveling Agent.
6. Sequestering, Dispersing and Leveling Agent for Reactive dyeing.
7. Antifoam.
8. Salt/Electrolyte
9. Carrier
10. pH Control and buffer system.
11. De-sizing agent
12. Scouring agent
13. Bleaching agent
14. Dispersing agent
15. Anti-pilling agent
16. Antifoaming agent
17. Yarn Lubricant
18. Mercerizing agent
19. Dye fixing agent
20. Optical Brightener.
21. Soaping Agent / Washing off Agent.
22. Softening agent

Functions of important auxiliaries are given below:

Dispersing Agents:
The dispersing agents is an organic compound which performs many function in dying. It assists the process dye particle size reduction and helps to solubilize dye particle i.e. dispersing agents increase solubility of disperse dye in water. Dispersant WS, Dadamol V, Hispogal, Licol OI, Sarcol NS etc are the example of dispersing agents.

Carrier:
Carrier is an organic compound which helps to take up dye at lower temperature and pressure over the textile material. Normally disperse dyeing is done in three ways on hydrophobic fibers (synthetic fibers). At the lowest temperature and pressure dyeing method is done with carrier dyeing. This substances are divided into four chemicals groups . Such as:

- Phenolic groups
- Prirnary amines

- Starch

Tumescal BDN, Carrylon GDX, Tumescal OP 45%, Teraux C, Superlene CR etc. are the example of carriers.

Sequestering agent:
Sequestering agent is very important auxiliaries in dyeing. It is used to remove hardness of water.

Peroxide killer:
Peroxide is harmful for the material. It is used to destroy the remaining peroxide content. Peroxide killers added at the stage of pre bleaching and also at peroxide bleaching processes.

Antifoaming agent:
It is one type surfactant which is able to reduce or prevent foam. Usually used in dyeing bath and in printing paste to prevent foam generation. Excess foam generation can create adverse effect in processing and product. It also reduces dyeing uptake percentage.

Anti-pilling agent:
Some manmade fiber and blended fiber fabrics can easily form pills in their surface. Anti-pilling agent plays a vital role in reducing the pilling in fabrics.

Source: https://textilelearner.blogspot.com/2011/12/dyeing-auxiliaries-classification-of.html

	Presentation on Exhaust dyeing process https://www.slideshare.net/asifalilakho3/exhaust-dyeing-process 21 slides

	Presentation on Exhaust dyeing process https://www.slideshare.net/sheshir/dyeing-parameter 51 slides

Introduction of Direct Dyes | Classification of Direct Dye | Application of Direct Dyes | After treatment of Direct Dye

Direct Dye:

Direct Dye is a class of dyestuffs that are applied directly to the substrate in a neutral or alkaline bath. They produce full shades on cotton and linen without mordanting and can also be applied to rayon, silk, and wool. Direct dyes give bright shades but exhibit poor wash fastness. Various after treatments are used to improve the wash fastness of direct dyes, and such dyes are referred to as “after treated direct colors.”**Direct Dyes** are molecules that adhere to the fabric molecules without help from other chemicals. Direct dyes are defined as anionic dyes with substantivity for cellulosic fibres, normally applied from an aqueous dyebath containing an electrolyte, either sodium chloride (NaCl) or sodium sulfate (Na2SO4)..

Direct Dyes

The dyeing process with direct dyes is very simple, Direct dyeing is normally carried out in a neutral or slight alkaline dyebath, at or near boiling point , but a separate after treatment such as cationic dye fixing , to enhance wet fastness has been necessary for most direct dyeing .

Direct dyes are used on cotton, paper, leather, wool, silk and nylon. They are also used as pH indicators and as biological stains.

Chemicals Nature of Direct Dyes:

Chemically they are salts of complex sulfonic acids.

Structure:-More than 75% of all direct dyes are unmetallised azo structures, great majority of them are disazo or polyazo types.

Ionic Nature:-Their ionic nature is anionic.

Solubility:-They are soluble in water .

Affinity:-They have an affinity for a wide variety of fibers such as cotton, viscose, silk, jute, linen etc.. They do not make any permanent chemical bond with the cellulosic fibers but are attached to it via very week hydrogen bonding as well as vander waals forces. Their flat shape and their length enable them to lie along-side cellulose fibers and maximize the Van-der-Waals, dipole and hydrogen bonds.

Types of Direct Dyes:

The SDC classification of direct dyes is follows

(1) Class A – dyes that are self-levelling, i.e. dyes of good migration or leveling properties.

(2) Class B – dyes that are not self-levelling, but which can be controlled by addition of salt to give level results; they are described as salt-controllable.

(3) Class C – dyes that are not self-levelling and which are highly sensitive to salt, the exhaustion of these dyes cannot adequately be controlled by addition of salt alone and they require additional control by temperature; they are described as temperature-controllable.

Application of Direct Dyes

Direct dyes are usually applied with the addition of electrolyte at or near the boil in the machines capable of running at atmospheric pressure .But in HTHP dyeing machines it is carried out at temperatures above the boil in case of pure as well as blended yarns.

An addition of alkali, usually sodium carbonate, may be made with acid-sensitive direct dyes and with hard water as well as to enhance the dye solubilisation. When cellulose is immersed in a solution of a direct dye it absorbs dye from the solution until equilibrium is attained, and at this stage most of

the dye is taken up by the fibre. The rate of absorption and equilibrium exhaustion varies from dye to dye. The substantively of the dye for cellulose is the proportion of the dye absorbed by the fibre compared with that remaining in the dyebath.

Dyeing Method

The color is pasted well and dissolved in boiling water to get a lump free solution .An addition of 0.5–2 g l–1 sodium carbonate may be advantageous when applying dyes of only moderate solubility in full depths.

- The dye bath is set at 40°C,
- Raise to the boil at 2 deg C min–1
- Hold at the boil for 30–45 min,
- During hold add 10–15 g l–1 of sodium chloride or calcined Glauber's salt. Light shades are dyed without or lesser addition of salt.
- Improved yields can be achieved when applying full depths by cooling to 80°C at the end of the period at the boil, adding a further 5 g l–1 salt and rising to the boil again
- Dye bath variables which must be considered for level dyeing,

1. Temperature of Dyeing and rate of heating

2. Electrolyte concentration and addition

3. Time

4. Dye solubility

5. Use of leveling agent

After Treatment of Direct Dyed Material

The wet fastness properties (particularly washing, water and perspiration) of virtually all dyeing of direct dyes are inadequate for many end uses but notable improvements can be brought about by after treatments.

- Diazotization and development
- Metal salt treatments
- Cationic fixing agents
- Formaldehyde treatment
- Cross linking agents and resin treatments

Stripping: Most direct dyes can be stripped of the use of stripping salts (Sodium Hydrosulphite) and/or by using a chlorine bleaching agent such as sodium hypochlorite, without harmful effects on the fibres.

Color fastness properties of Direct Dyed material: Generally these dyes are used where high wash fastness is not required.

Wash Fastness: Poor unless treated with suitable dye fixing agent and/or fastness improving finishing agent.

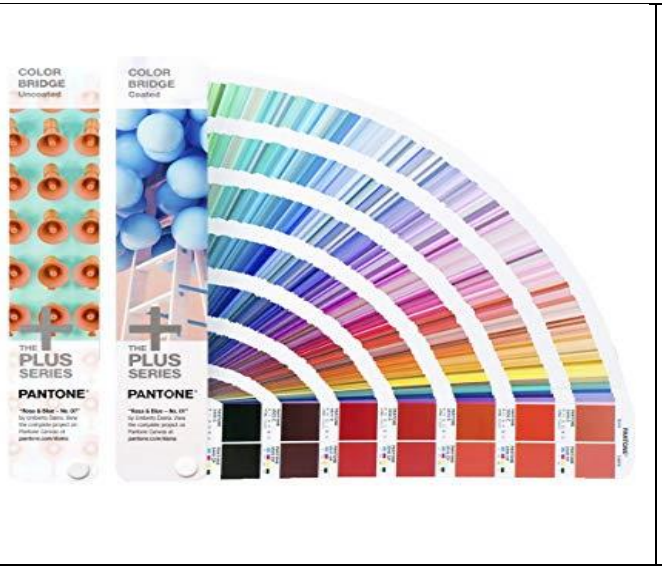
Light Fastness:-Good

Rubbing Fastness: Moderate to Good

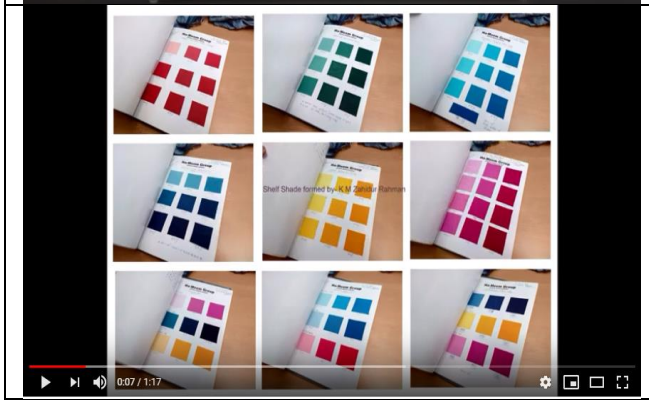
Chemical Wash Fastness:- Poor

Source: https://textilelearner.blogspot.com/2011/02/defination-classification-application_2111.html

Images of color matching and pantone book.



Videos:

	Match Textile: Matching A New Color https://www.youtube.com/watch?v=m7umpoU4sLM Duration: 00:05:12
	Color Matching Cabinet, Color Matching Equipment, Matching Box https://www.youtube.com/watch?v=_XmoDuvhwBI Duration: 00:00:42
	Textile Dyeing Color Recipe & Shade Percentage Book https://www.youtube.com/watch?v=fgTzBWdxElc Duration: 00:01:42

TEXTILE WET PROCESSING

Module-7

LEARNER GUIDE

National Vocational Certificate Level 3

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Module 7: 0723001102 Carry out Exhaust Dyeing for Knitted Fabrics.

Objective of the module: This competency standard covers the skills and knowledge required to prepare and ensure dyeing parameters for knitted fabric dyeing by exhaust method according to dyeing plan with skills of shade matching under the required quality standards.

Duration: 80 hours **Theory:** 16 hours **Practical:** 64 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Follow Dyeing Plan for Knitted fabric dyeing by exhaust process	**The trainee will be able to:** Receive RFD (Ready for Dyeing) fabric for exhaust dyeing according to program sheet. Receive shade standards for shade matching.. Arrange material for dyeing process as per program sheet. Interpret specs for exhaust dyeing process.	Knowledge of processing of knitted fabric ready for dyeing (RFD) used for dyeing at exhaust dyeing methods. Identifying shade required for the dyeing as per customer's order. Knowledge of methods of shade matching. Types of dyes, chemicals and auxiliaries used for exhaust dyeing for knitted fabrics. Understanding the spec sheet / order sheet for processing the exhaust dyeing on knitted fabrics.	Soft flow dyeing machine Winch dyeing machine Over lock machine Related Chemicals and dyes
LU2: Prepare and ensure knitted fabric dyeing parameters for exhaust dyeing	**The trainee will be able to:** Instruct exhaust dyeing machine operators for dyeing process according to given parameters. Calculate amount of dyes and chemicals as per given in recipe for production as per dyeing plan. Execute dyes and chemical preparation for exhaust dyeing at production level. Set machine parameters for exhaust dyeing process.	Knowledge of dyeing parameters such as pH, temperature, TDS, liquor ratio, chemicals and auxiliaries used during knitted fabric dyeing at exhaust dyeing process. Calculating skills for dyes and chemical calculations according to given recipe. Preparing dyes and chemicals and conversion knowledge from recipe level to the production level. Setting of machine parameters like speed, capacity, working principle, temperature control, productivity, steam, air valve, water etc. Knowledge of machine speed and proper handling of machine according to the type of operations,	Soft flow dyeing machine Winch dyeing machine Over lock machine Iron Tape

	Verify process parameters for dyeing as per dyeing plan. Supervise safety precautions as per job requirement.	fabrics and product type. Verifying all parameters for machine and dyeing process according to dyeing plan. Supervising and verifying the safety precautions required for dyeing operators before start of machine operations.	
LU3: Identify shade by using shade matching method for Knitted fabrics	**The trainee will be able to:** Verify shade standards for shade matching. Match shade as per standards and make corrections if required.	Knowledge of various methods used for shade matching like spectrophotometer and light box with understanding of standard pantone book. Knowledge of shade matching, variation and make correction if any.	Spectrophotometer Light Box Pantone Book Consistency cards for shade variation
LU4: Perform Dyeing	**The trainee will be able to:** Arrange material for dyeing process as program sheet. Execute production on set parameters according to program.	Operational knowledge of exhaust dyeing machine for knitted fabric dyeing with required parameters like speed, capacity, working principle, temperature control, productivity, steam, air valve, water etc. Differentiating the dyeing process for knitted dyeing at exhaust machines like soft flow and winch.	Soft flow dyeing machine Winch dyeing machine
LU5: Verify quality of Knitted fabric dyeing by exhaust process	**The trainee will be able to:** Verify quality parameters during production for matching with standards. Inspect physically dyeing process to maintain quality & in-time production Take corrective actions for any issues concerned with quality according to requirement.	Verifying methods of quality parameters such as pH, temperature, TDS, liquor ratio, chemicals and auxiliaries used during knitted fabric dyeing at exhaust dyeing process. Inspecting the dyeing process for maintaining quality and timely completion of process. Troubleshooting of issues concerned with quality of dyeing process at exhaust dyeing methods.	Light Box Iron Tape Pantone Book

LU6: **Prepare production report for Knitted fabric dyeing by exhaust process**	**The trainee will be able to:** Verify production register maintain by machine operators shift-wise. Calculate and Record efficiency of every machine for evaluating machine production progress. Calculate down time shift wise to verify productivity. Prepare shift production report. Prepare faults (machine and material) reports occurred during shift. Prepare and issue job card for electrical and mechanical faults to concerned person for its remedies.	Verifying of recording of machine and dyeing parameters like temperature variation, time consumption, fault detection, parts positions, chemicals and auxiliaries adding time during dyeing process etc on production register Calculating efficiency of every machine and evaluating operator's capacity for future settings for production. Advantages of recording the running and stoppage time of machine for calculating machine and operator's efficiency on production register. Verifying the shift production and evaluating faults occurs during shift for finding its causes and remedies in future dyeing plan. Knowledge of machine and process faults occurring during shift for dyeing process. Preparing and issuing job card for electrical and mechanical faults with their remedies.	Computer Calculator Telephone Printer Stationary

10 causes and remedies of running shade in knit dyeing

Running shade in knit dyeing factories is the most common and frequently happening problem which leads to a huge loss for the factory in terms of money and time.

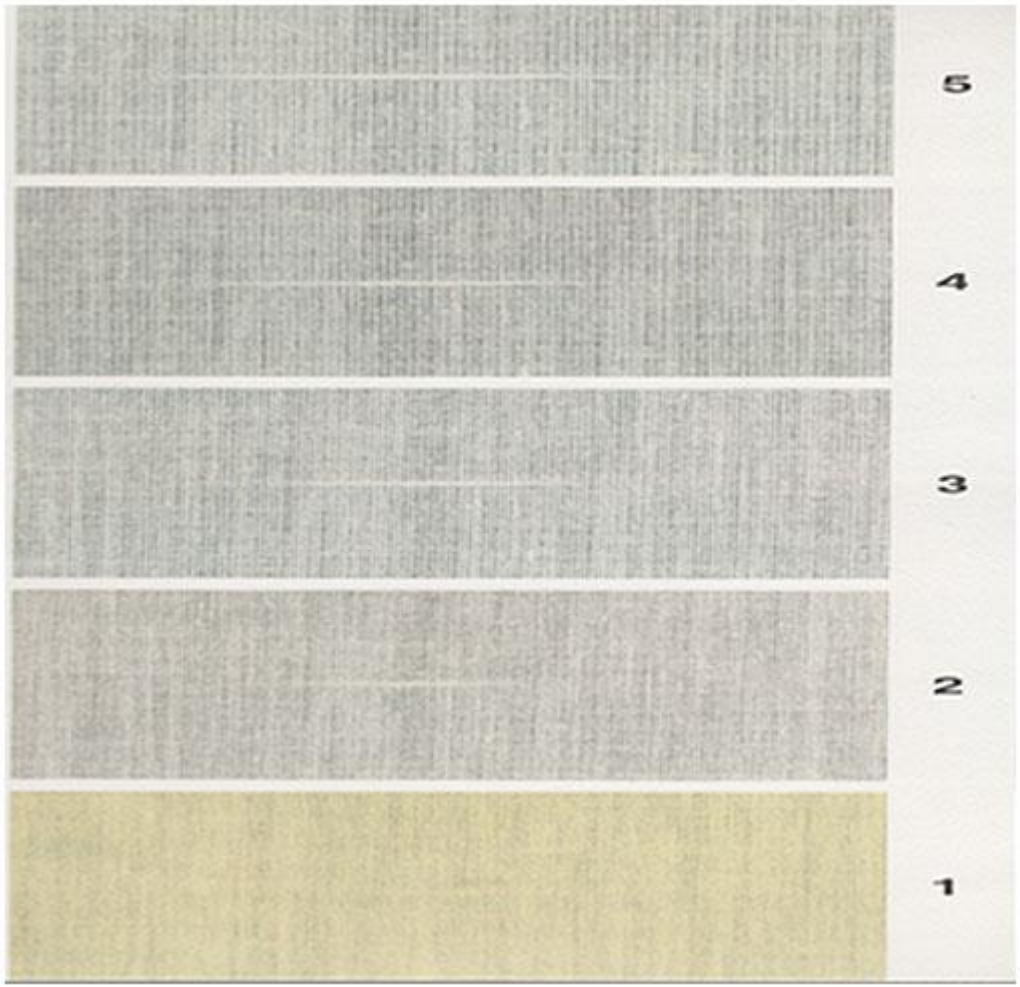


Figure 1: When dyes cannot migrate properly in the whole fabric thus exhaustion of dyes in fabric becomes uneven which leads to running shade or uneven dyeing.

What is running shade?
Running shade is more specifically meter to meter variation of shade in fabric. So, basically when dyes cannot migrate properly in the whole fabric thus exhaustion of dyes in fabric becomes uneven which leads to running shade or uneven dyeing.

If running shade occurs, definitely there needs re-process which causes some severe problems. Running shade also hampers production time, reduce efficiency and production output which directly converted into money.

- Shrinkage problem
- GSM problem
- Poor fabric strength and fabric quality
- Importantly fabric surface become hairier
- Not meeting the lead time
- Extra chemical and process cost etc.

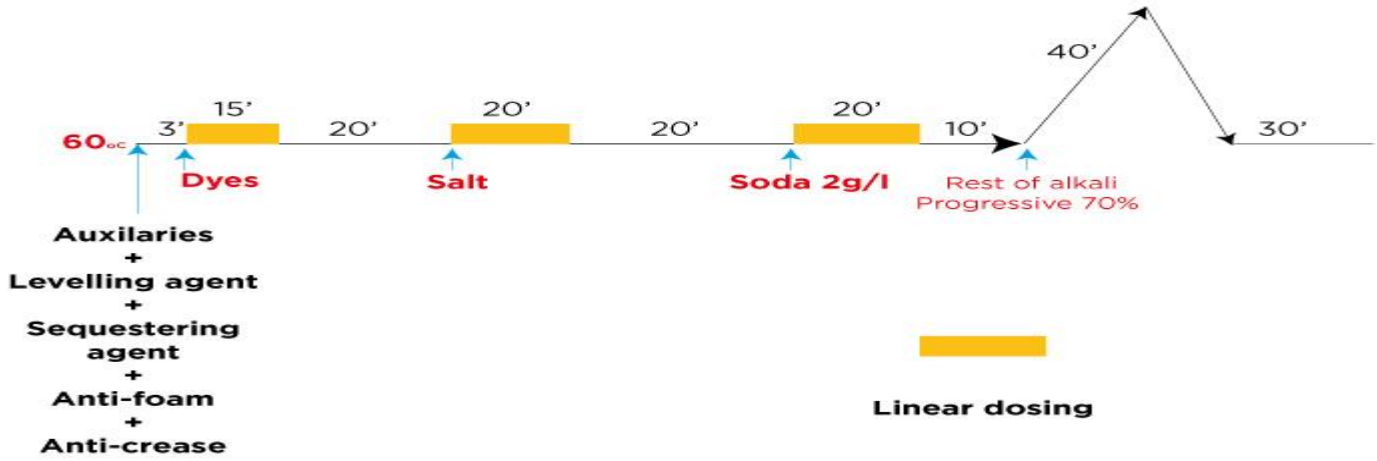


Figure 2: Standard procedure to dye evenly in knit dyeing.

Causes and remedies of running shade

So, there are some important causes which lead to running shade which is given below-

1. Lack of proper combination of dyes
2. Not maintaining exact dyeing process
3. Lack of proper amount of salt and alkali dosing
4. Lack of quality products and proper products in the bath
5. Lack of proper alkali dosing
6. Lack of proper pretreatment
7. Not selecting good leveling agent
8. Lack of awareness for water quality
9. Not maintaining proper machine and material operation by the operator
10. Lack of proper after treatment

Possible remedies of running shade are given below-

1. First of all, the combination of dyes meaning the exhaustion and fixation curve of the dyes must be more or less similar. If there is a significant difference, it will create running shade.
2. Dyeing process: Standard dyeing process should be maintained that means dosing of chemicals and dyes should be of sequence wise and maintain required temperature and pH for the specific chemical and dyes.
3. The proper amount of salt and alkali needed in the liquor because if there is excess salt in the liquor then fiber affinity will be increased thus migration of dyes will be less which leads running shade.
4. Select quality product and proper product for a specific purpose.
5. Properly alkali dosing is important because when pH > 9.9 then dyes will not migrate only fixation will occur.
6. Proper pre-treatment is badly needed to make sure fabric and liquor is free from impurities, so, a good wash is mandatory. (For better result, one may use- Persoclean STN)
7. Good leveling agent should be used. On the other way, dyes will be precipitated because when there is the hardness in the water, metal gets complex bond with dyes thus improper dyes distribution in the liquor causes running shade.
8. Ensure good water quality (standard less than 40ppm). If it is 40 or less than 40 then use sequestering agent and if it is <= 10ppm, sequestering agent will not be required.
9. The operator should be aware of machine and material operation which means sequence of dosing amount of dosing and machine RPM.
10. Lastly, proper after treatment is essential. When using softener, proper PH and softener size is must and when there is excessive unfixed dyes on the surface of fabric use proper soap to remove it perfectly.

Source: https://www.textiletoday.com.bd/10-causes-and-remedies-of-running-shade-in-knit-dyeing/

BASICS OF KNITTING PROCESSING OF KNITTED FABRIC

The knitted fabrics undergo a series of different chemical processing treatments like scouring, bleaching, dyeing, softener padding and relax drying. These processes are carried out to impart a particular property related to that process like scouring for absorbency, bleaching for whiteness, dyeing to impart colour to fabric and finishing for improving softness and handle of the fabric.

The properties of the knitted fabrics are influenced by various parameters like raw material, yarn structure, fabric structure, processing stages and finishing. The process adopted affects the fabric properties and its overall performance. During the finishing process, internal stresses stored during spinning, knitting

is removed and the fabrics attain an almost fully relaxed state. By adopting different processes and finishing methods, different kinds of knitted fabric in a sense of aesthetic and utility properties can be produced from the same unfinished fabrics. Further, the determination of the changes in physical and dyeing properties during different stages of chemical processing is important for the control of process parameters to get the final product as per the requirements of the buyer.

The knits goods, in contrast to the woven cotton fabrics, are easily starched and their loops would get distorted under the stretching tension of the dyeing cylinders. Special drying machines have, therefore, been developed to dry knitwear with the minimum of tension.

DYEING OF KNITTED FABRICS

Jets and Winch dyeing machines are usually used as exhaust equipment for preparation, dyeing and finishing of knitted fabrics. Jet dyeing is the best example of a machine that circulates both the fabric and the dye bath. Jet dye machines are excellent for knit fabrics.

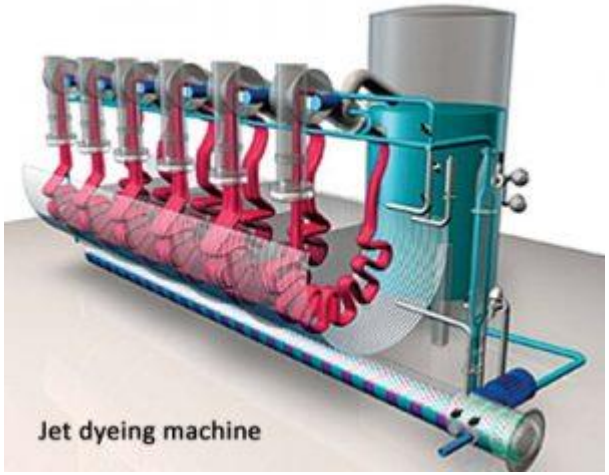
Knit fabric wet processing is started with batching or batch preparation where fabric is weighted as per machine capacity and the fabric is turned to inside out in case of body fabric i.e. main fabric of garments. Normally, single jersey fabric such as plain, locust, pique etc. are widely used for body fabric of garments. Interlock, rib, fleece fabrics are also turned to inside out when those are in unbalanced structures and used as body fabric of garments. The fabrics are usually turned to keep away from the any unaccepted incident or damage on face side and remove edge marks, which are created due to formation of fabric roll.

Fabrics that are processed and delivered in tubular form are treated on becks, in jets, or in continuous machines. Relaxation takes place during the entire wet treatment.

Subsequently, the goods are hydro extracted, dried in jet ribbon driers without setting, and then calendared. Since the product is not subjected to any setting, the required shrink resistance must be reached by shrinking the product sufficiently (by maximum overfeed in longitudinal direction, no stretching to the limit in vertical direction) during other finishing procedures.

Circular knits that must be delivered openwidth and be subjected to heat setting in order to create dimensional stability and to reduce the tendency to curl at the edges can be dyed in rope form or open-width. Which technique is chosen depends primarily on the fabric properties but also on the equipment availability.

Fabrics that are not prone to creasing can be rope-dyed without any risk of crease formation; additional advantages of this method are a large fabric volume and a soft touch. Knits that are prone to creasing should be dyed open-width on the beam to ensure a smooth finished product without creases.
Any open-width dyeing must be preceded by a reliable heat setting. Otherwise the knitted fabric will shrink in width, which results in colour irregularities because part of the beam perforation becomes uncovered. In addition, moiré effects will occur. With beam dyeing, smooth, elegant, but also less voluminous final qualities are achieved.

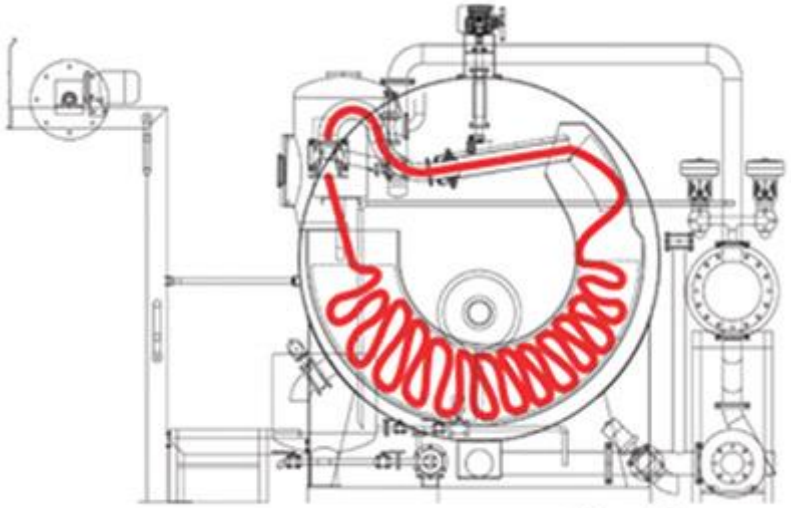


PROBLEMS IN KNIT DYEING

Maximum knit fabric problems are created during preparation, dyeing and after treatment process. Common problems of knit dyeing are edge mark, crease mark, pin hole, loss of fabric strength, shade variation of batch-to-batch, uneven dyeing (such as roll to roll shade variation, patchy, colour spot, white spot, meter to meter shade variation), hand feel problem, fastness problems etc.

Precaution for edge mark and crease mark

- In case of edge mark fabric is turned before wet processing
- Gray fabric roll should not too tight and should not store for a long time
- For crease marks anti-creasing chemicals can be used
- Convenient machine speed (with fabric compactness)
- Correct loading (no twisted rope and knots)
- Relaxation of fabric
- Proper dyeing process (heating-cooling rates not too rapid)
- Avoid overloading, which might cause mechanical frictions
- Tight construction of fabric, high twisted yarns and high GSM need to be avoided



Flow Diagram

Precaution for maintaining fabric strength

- Contamination of sulphuric acid with acetic acid
- Longer process with excess scouring bleaching chemicals
- Delay of killing the enzymes
- Very high speed of machine
- Too long dyeing (corrective or repairing) process

Shade variation batch to batch

- Process parameters such as water hardness, M:L, time, temperature, recipe, reproducibility of dyes, dye lot, fabric structure, GSM, fibre lot, yarn count etc. should be same as much as possible for minimising batch to batch shade variation problem.

Roll to roll shade variation and patchy

- Roll to roll shade variation produces a variety of shade within a batch
- Avoid fabric roll produced from different fibre lot, yarn count, GSM, structure and even sometime for different machines
- Avoid mixing of different types of fabrics
- Patchy is the real uneven dyeing
- Avoid uneven absorbency, electrolytes (salt) alkaline pH, uneven and sudden alkali dosing, wrong dye combinations, improper mixing of dyes, improper neutralization after scouring-bleaching and dyeing, fabric entanglement during process etc.

Colour spot and white specks

- Avoid improper colour mixing
- Avoid water hardness and presence of heavy metal sulphate, sulphides, sulphites and alkali especially caustic soda
- Water treatment plant (WTP), sequestering agent and proper mixing of dyes are fundamental solution of colour spot
- White specks are mainly yarn problem i.e. dead or immature fibres
- Moreover contamination in water, improper dissolve of alkali and presence of silica based chemical before dyeing also arise white spots

Hand feel and Fuzzy appearance

- Hand feel problem can be easily reduce by demineralisation and can improve by the addition of softener
- Fuzzy appearance comes because of fabric to fabric, fabric to chemicals and fabric to machine abrasion in presence of high temperature for a long period of time

Fastness problems

- Fastness problems are result of improper washing off, presence of unfix dyes, hydrolysis of dyes, dyeing with excessive dyes, poor fastness properties of dyes, improper use of fixer and softener.
  Source: https://knittingviewsbd.com/basics-of-knitting-processing-of-knitted-fabric/

TEXTILE WET PROCESSING

Module-8

LEARNER GUIDE

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 8: 0723001103 Carry out Semi-Continuous Dyeing

Objective of the module: his competency standard covers the skills and knowledge required to prepare and ensure dyeing parameters for fabric dyeing by semi-continuous dyeing method according to dyeing plan with skills of shade matching under the required quality standards.

Duration: 80 hours **Theory:** 16 hours **Practical:** 64 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Follow Dyeing Plan for semi-continuous dyeing	**The trainee will be able to:** Receive RFD (Ready for Dyeing) fabric for semi-continuous dyeing according to program sheet. Receive shade standards for shade matching.. Arrange material for dyeing process as program sheet. Interpret specs for exhaust dyeing process.	Knowledge of processing of fabric (substrate) ready for dyeing (RFD) used for dyeing at semi-continuous dyeing methods. Identifying shade required for the dyeing as per customer's order. Knowledge of methods of shade matching. Types of dyes, chemicals and auxiliaries used for semi-continuous dyeing for fabrics. Understanding the spec sheet / order sheet for processing the semi-continuous dyeing on fabrics.	Pad Batch dyeing machine Related Chemicals and dyes
LU2: Prepare and ensure dyeing parameters for semi-continuous dyeing	**The trainee will be able to:** Instruct semi-continuous dyeing machine operators for dyeing process according to given parameters. Calculate amount of dyes and chemicals as per given in recipe for production as per dyeing plan. Execute dyes and chemical preparation for exhaust dyeing at production level. Set machine parameters for exhaust dyeing process.	Knowledge of dyeing parameters such as pH, temperature, TDS, dye pick-up, chemicals and auxiliaries used during fabric dyeing at semi-continuous dyeing process. Calculating skills for dyes and chemical calculations according to given recipe. Preparing dyes and chemicals and conversion knowledge from recipe level to the production level. Setting of machine parameters like speed, capacity, working principle, temperature control, productivity, steam, air valve, water etc. Knowledge of machine speed and proper handling of machine according to the type of operations, fabrics	Pad Batch dyeing machine Iron Tape

	Verify process parameters for dyeing as per dyeing plan. Supervise safety precautions as per job requirement.	and product type. Verifying all parameters for machine and dyeing process according to dyeing plan. Supervising and verifying the safety precautions required for dyeing operators before start of machine operations.	
LU3: **Identify shade by using shade matching method for semi-continuous dyeing**	**The trainee will be able to:** Verify shade standards for shade matching. Match shade as per standards and make corrections if required.	Knowledge of various methods used for shade matching like spectrophotometer and light box with understanding of standard pantone book. Knowledge of shade matching, variation and make correction if any.	Spectrophotometer Light Box Pantone Book Consistency cards for shade variation
LU4: Perform Dyeing	**The trainee will be able to:** Arrange material for dyeing process as program sheet. Execute production on set parameters according to program.	Operational knowledge of semi-continuous dyeing machine for fabric dyeing with required parameters like speed, capacity, working principle, temperature control, productivity, steam, air valve, water etc. Differentiating the dyeing process for dyeing at semi-continuous machines like Pad batch and pad jig.	Pad batch dyeing machine
LU5: **Verify quality for semi-continuous dyeing process**	**The trainee will be able to:** Verify quality parameters during production for matching with standards. Inspect physically dyeing process to maintain quality & in-time production Take corrective actions for any	Verifying methods of quality parameters such as pH, temperature, TDS, dye pick-up, chemicals and auxiliaries used during fabric dyeing at semi-continuous dyeing process. Inspecting the dyeing process for maintaining quality and timely completion of process. Troubleshooting of issues concerned with quality of dyeing process at semi-continuous dyeing methods.	Light Box Iron Tape Pantone Book

	issues concerned with quality according to requirement.		
LU6: **Prepare production report for semi-continuous dyeing process**	**The trainee will be able to:** Verify production register maintain by machine operators shift-wise. Calculate and Record efficiency of every machine for evaluating machine production progress. Prepare shift production report. Prepare reports for faults occur during shift.	Verifying of recording of machine and dyeing parameters like temperature variation, time consumption, fault detection, parts positions, chemicals and auxiliaries adding time during dyeing process etc on production register Calculating efficiency of every machine and evaluating operator's capacity for future settings for production. Advantages of recording the running and stoppage time of machine for calculating machine and operator's efficiency on production register. Verifying the shift production and evaluating faults occurs during shift for finding its causes and remedies in future dyeing plan.	Computer Calculator Telephone Printer Stationary

Semi-Continuous Dyeing Process

In the process of semi-continuous dyeing that consists of pad-batch, pad-jig, pad-roll the fabric is first impregnated with the dye-liquor in, what is called a padding machine. Then it is subjected to batch wise treatment in a jigger. It could also be stored with a slow rotation for many hours. In the pad-batch this treatment is done at room temperature while in pad-roll it is done at increased temperature by employing a heating chamber. This helps in fixation of the dyes on to the fibre. After this fixation process, the material in full width is thoroughly cleansed and rinsed in continuous washing machines. There is only one point of difference between Continuous and semi-continuous dyeing process is that in semi-continuous dyeing, the dye is applied continuously by a padding. The fixation and washing remaining discontinuous. Liquor Ratio in semi-continuous dyeing is not of much importance and is not taken as a parameter. One of the widely used techniques for semi-continuous dyeing process is the Pad Batch Dyeing a schematic diagram is given here for the semi-continuous dyeing process.

Name Of Some Semi-Continuous dyeing Process

1. Pad Batch
2. Pad-jig process
3. Pad-roll process

Pad Batch Process

Pad Batch Dyeing is one of the widely used technique for semi-continuous dyeing process. It is mainly used in the dyeing of cellulosic fibre like cotton or viscose (knit and woven fabric) with reactive dyes. Pad batch dyeing is a textile dyeing process that offers some unique advantages in the form of versatility, simplicity, and flexibility and a substantial reduction in capital investment for equipment. It is primarily a cold method that is the reason why it is sometimes referred to as the cold pad batch dyeing.
Source: http://textilesite.blogspot.com/2012/03/dyeing-process.html

Special Features of Pad Batch Dyeing Process

- Significant cost and waste reduction as compared to other conventional dyeing processes.
- Total elimination of the need for salt and other specialty chemicals. For example there is no need for anti-migrants, leveling agents and fixatives that are necessary in conventional dyebaths.
- Optimum utilization of dyes that eliminates specialty chemicals, cuts down chemical costs and waste loads in the effluent. All this results in a formidable reduction in wastewater treatment costs.
- Excellent wet fastness properties.
- Pad batch dyeing cuts energy and water consumption owing to low bath ratio (dye:water) required for the process. This is because unlike other dyeing processes it does not function at high temperatures.
- A uniform dye quality is achieved with even color absorbency and colour fastness.
- As compared to rope dyeing, Pad batch dyeing produces much lower defect levels.
- In pad batch dyeing, qualities like high shade reliability and repeatability are common. This is because of high reactivity dyes with rapid fixation rate and stability.
- Lastly Pad batch dyeing can also improve product quality. The fabric undergoing the cold pad batch dyeing process is able to retain an uniformly coloured appearance. It shows added luster and gives a gentle feel. The fabric gives a brighter look in shades.

  Source: http://www.geocities.ws/dyes_pigments/semi-continuous-process.html

Dyeing Auxiliaries

Acid

A chemical that will produce a pH of less than 7 in water solution. Many acids are used in dyeing. They include acetic acid, citric acid, formic acid , hydrochloric acid and sulfuric acid. Several other compounds, such as sodium bi sulfate and ammonium sulfate form acids in solution through hydrolysis. When making solutions of acids or when diluting concentrated acids, always add the acid to water, never the other way around. This is because some acids produce a great deal of heat when they mix with water so much that a small amount of water added to a large amount of acid may actually boil and cause extremely dangerous spattering.

Alkali

A subclass of base, though often used to refer to any base. Partly because the term “basic” is often rather confusing, “alkaline” is often used to refer to solutions that are basic - having pH greater than 7. Some common alkali used in textiles are sodium hydroxide, potassium hydroxide.

Carriers

There are some dyeing assistants which are used in altering the dispersing propertied of the dyes and also change the physical and chemical properties of the fibre. These are called carriers. Carriers are certain hydrocarbon, Substituted hydrocarbon, Phenols, amino acids, amides, alcohol, asters, ketone etc. They accelerate the rate of dyeing of polyester fibre with disperse dyes from aqueous dyeing medium of up to 100^0 C. In these way carriers helps the transfer of dye molecule from dye bath on to the fiber for dyeing polyester fabric.

Dispersing agent

The dispersing agent is used to assist the disperse dye to solubilize in water so that the dye molecule can be transferred from the dye bath to the textile substrate. Dispersing agent is used for dyeing the polyester fiber. Dispersing agent should be such that it is effective under dyeing or printing conditions and should be suitable to dye with hard water, high temperature and dyeing assistant.

Dye Fixing Agent

Properties of a good fixing agent includes good capability with cross linking agents without promoting yellowing effect; good leveling and migration properties, does not affect the shade, has good affinity for the fiber, stable to steaming and dry heat, and improved all round fastness properties of the fabric or yarn. Fixative is generally used after completing the dyeing or in printing paste.

Leveling agent/Retarder

A chemical added to a dye bath to reduce the rate at which dye attaches to the fiber; also called leveling agents. A retarder may be required to prevent a dye from attaching to fibers so quickly that it would be very difficult to achieve level dyeing. Retarders are often used with acid dyes. They may work by

quickly attaching to the fiber thereby temporarily keeping the dye from attaching, or by quickly attaching to the dye, temporarily keeping the fiber from attaching to the dye. Simple chemicals such as sodium sulfate may act as retarders for some dyes in some conditions. There are many retarders on the market that are proprietary mixtures of chemicals, often formulated to be companions for specific dye families. Reserving agents can be thought of as a special class of retarder. The availability to art dyers of retarders is limited. So leveling agents are used to level dyeing.

Reducing agent

A chemist's term for any chemical that causes gain of electrons by another chemical with which it reacts the reducing agent is itself oxidized in the process.Many reducing agents are used in dyeing processes. They include thiourea dioxide , sodium bisulfite, sodium formaldehyde sulfoxylate, sodium hydrosulfite and others. They are often used in discharge and stripping processes, and are used for converting insoluble vat or sulfur dyes to the soluble form. Solid-chemical reducing agents are often flammable.

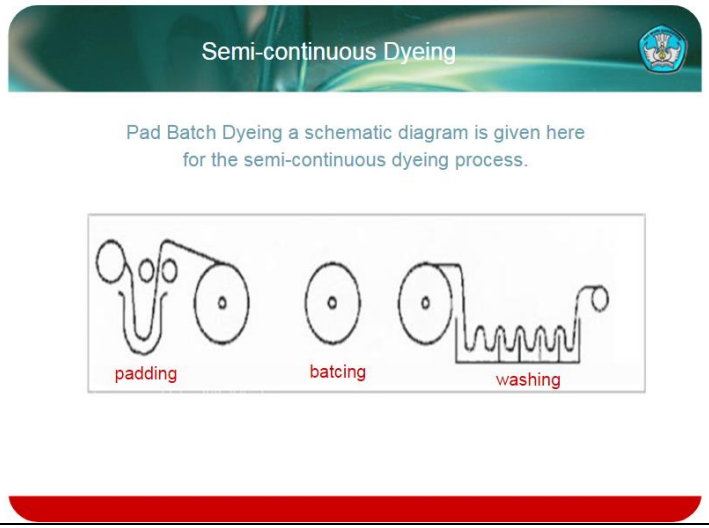
Salt

An ionic compound that is formed by a neutralization reaction (reaction of an acid with a base). The best known salt, common salt, or sodium chloride (NaCl) is extensively used as an electrolyte in dyeing.

Sequestering agent

The most undesirable impurities in Fibre, Common salt, Glauber salt, Caustic Soda and Soda ash are the di- and tri-valent cations e.g. Ca^{++} ,Mg^{++} ,Cu^{++}, Fe^{+++} etc. These ions increase hardness of the process bath and generate iron oxides in the bath. Calcium and Magnesium reacts with alkali and precipitates as a sticky substance on the textile material, which creates patchy dyeing and discoloration of the fibre. The ferric oxide with cellulose and creates small pinhole on the fibres also damages the machinery by scale formation in the nozzles and base. To overcome these deleterious effects in the scouring and bleaching bath adequate amount of sequestering agent must be used. Sequestering agents prevent di-and tri-valentmetal ions from interfering with the chemical processing of the textile material. It prevents catalytic damage of cellulosic fibres in bleaching bath during hydrogen peroxide bleaching.

Source: http://textilesite.blogspot.com/search/label/Dyeing%20Auxiliaries

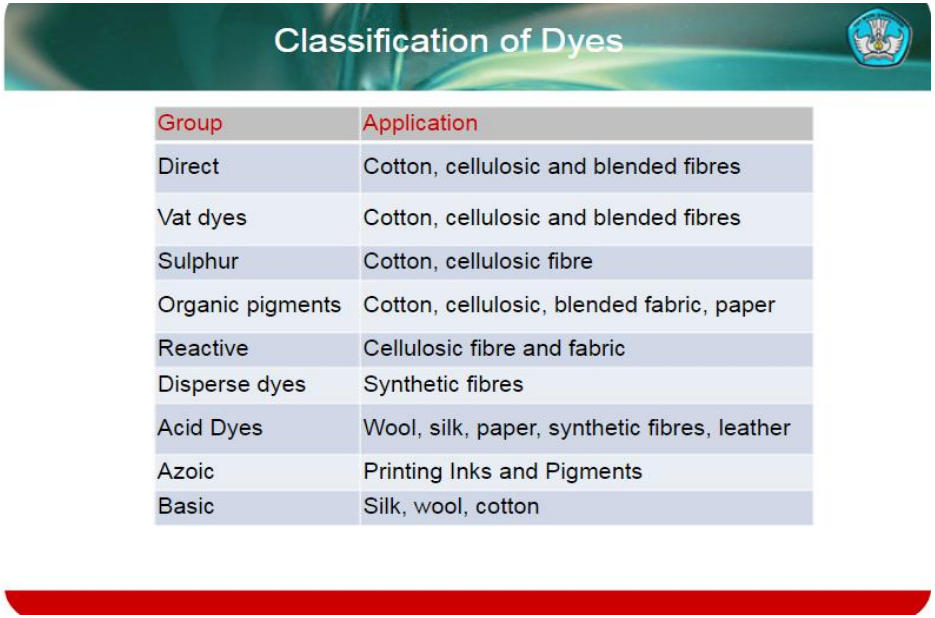


Brief Presentation:

DYEING Textile Finishing Technology

https://slideplayer.com/slide/11585949/

Slides: 73



Group	Application
Direct	Cotton, cellulosic and blended fibres
Vat dyes	Cotton, cellulosic and blended fibres
Sulphur	Cotton, cellulosic fibre
Organic pigments	Cotton, cellulosic, blended fabric, paper
Reactive	Cellulosic fibre and fabric
Disperse dyes	Synthetic fibres
Acid Dyes	Wool, silk, paper, synthetic fibres, leather
Azoic	Printing Inks and Pigments
Basic	Silk, wool, cotton

Videos:

	Batch Dyeing Procedure (Process of batch dyeing) https://www.youtube.com/watch?v=z1GBNyKGVqU Duration: 00:01:24
	Lab Pad Steam Range, Pad-Steam Range For Laboratory https://www.youtube.com/watch?v=gGgi9K8tKA4&t=72s Duration: 00:19:38

TEXTILE WET PROCESSING

Module-9

LEARNER GUIDE

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 9: 0723001104 Carry out Continuous Dyeing

Objective of the module: This competency standard covers the skills and knowledge required to prepare and ensure dyeing parameters for fabric dyeing by continuous dyeing method according to dyeing plan with skills of shade matching under the required quality standards.

Duration: 80 hours **Theory:** 16 hours **Practical:** 64 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Follow Dyeing Plan for continuous dyeing	**The trainee will be able to:** Receive RFD (Ready for Dyeing) fabric for continuous dyeing according to program sheet. Receive shade standards for shade matching.. Arrange material for dyeing process as program sheet. Interpret specs for exhaust dyeing process.	Knowledge of processing of fabric (substrate) ready for dyeing (RFD) used for dyeing at continuous dyeing methods. Identifying shade required for the dyeing as per customer's order. Knowledge of methods of shade matching. Types of dyes, chemicals and auxiliaries used for continuous dyeing for fabrics (substrate) Understanding the spec sheet / order sheet for processing the continuous dyeing on textile fabrics.	Pad Steam dyeing machine Pad Thermosol dyeing machine Related Chemicals and dyes
LU2: Prepare and ensure dyeing parameters for continuous dyeing	**The trainee will be able to:** Instruct continuous dyeing machine operators for dyeing process according to given parameters. Calculate amount of dyes and chemicals as per given in recipe for production as per dyeing plan. Execute dyes and chemical preparation for exhaust dyeing at production level. Set machine parameters for exhaust dyeing process.	Knowledge of dyeing parameters such as pH, temperature, TDS, liquor ratio, chemicals and auxiliaries used during knitted fabric dyeing at continuous dyeing process. Calculating skills for dyes and chemical calculations according to given recipe. Preparing dyes and chemicals and conversion knowledge from recipe level to the production level. Setting of machine parameters like speed, capacity, working principle, temperature control, productivity, steam, air valve, water etc. Knowledge of machine speed and proper handling of machine according to the type of operations, fabrics	Pad Steam dyeing machine Pad Thermosol dyeing machine Iron Tape

	Verify process parameters for dyeing as per dyeing plan. Supervise safety precautions as per job requirement.	and product type. Verifying all parameters for machine and dyeing process according to dyeing plan. Supervising and verifying the safety precautions required for dyeing operators before start of machine operations.	
LU3: **Identify shade by using shade matching method for continuous dyeing**	**The trainee will be able to:** Verify shade standards for shade matching. Match shade as per standards and make corrections if required.	Knowledge of various methods used for shade matching like spectrophotometer and light box with understanding of standard pantone book. Knowledge of shade matching, variation and make correction if any.	Spectrophotometer Light Box Pantone Book Consistency cards for shade variation
LU4: Perform Dyeing	**The trainee will be able to:** Arrange material for dyeing process as program sheet. Execute production on set parameters according to program.	Operational knowledge of continuous dyeing machine for fabric dyeing with required parameters like speed, capacity, working principle, temperature control, productivity, steam, air valve, water etc. Differentiating the dyeing process for dyeing at continuous machines like pad steam and pad thermosol.	Pad Steam dyeing machine Pad Thermosol dyeing machine
LU5: **Verify quality for continuous dyeing process**	**The trainee will be able to:** Verify quality parameters during production for matching with standards. Inspect physically dyeing process to maintain quality & in-time production Take corrective actions for any issues concerned with quality	Verifying methods of quality parameters such as pH, temperature, TDS, liquor ratio, chemicals and auxiliaries used during fabric dyeing at continuous dyeing process. Inspecting the dyeing process for maintaining quality and timely completion of process. Troubleshooting of issues concerned with quality of dyeing process at continuous dyeing methods.	Light Box Iron Tape Pantone Book

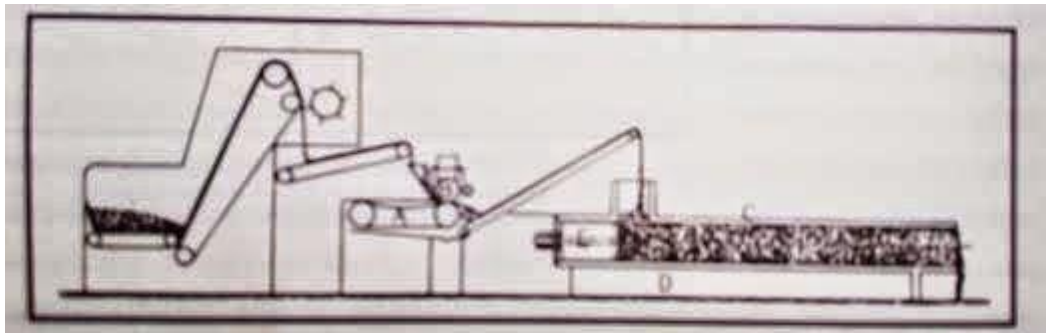
	according to requirement.		
LU6: **Prepare production report for continuous dyeing process**	**The trainee will be able to:** Verify production register maintain by machine operators shift-wise. Calculate and Record efficiency of every machine for evaluating machine production progress. Prepare shift production report. Prepare reports for faults occur during shift.	Verifying of recording of machine and dyeing parameters like temperature variation, time consumption, fault detection, parts positions, chemicals and auxiliaries adding time during dyeing process etc on production register Calculating efficiency of every machine and evaluating operator's capacity for future settings for production. Advantages of recording the running and stoppage time of machine for calculating machine and operator's efficiency on production register. Verifying the shift production and evaluating faults occurs during shift for finding its causes and remedies in future dyeing plan.	Computer Calculator Telephone Printer Stationary

Working Procedure of Continuous Dyeing Method

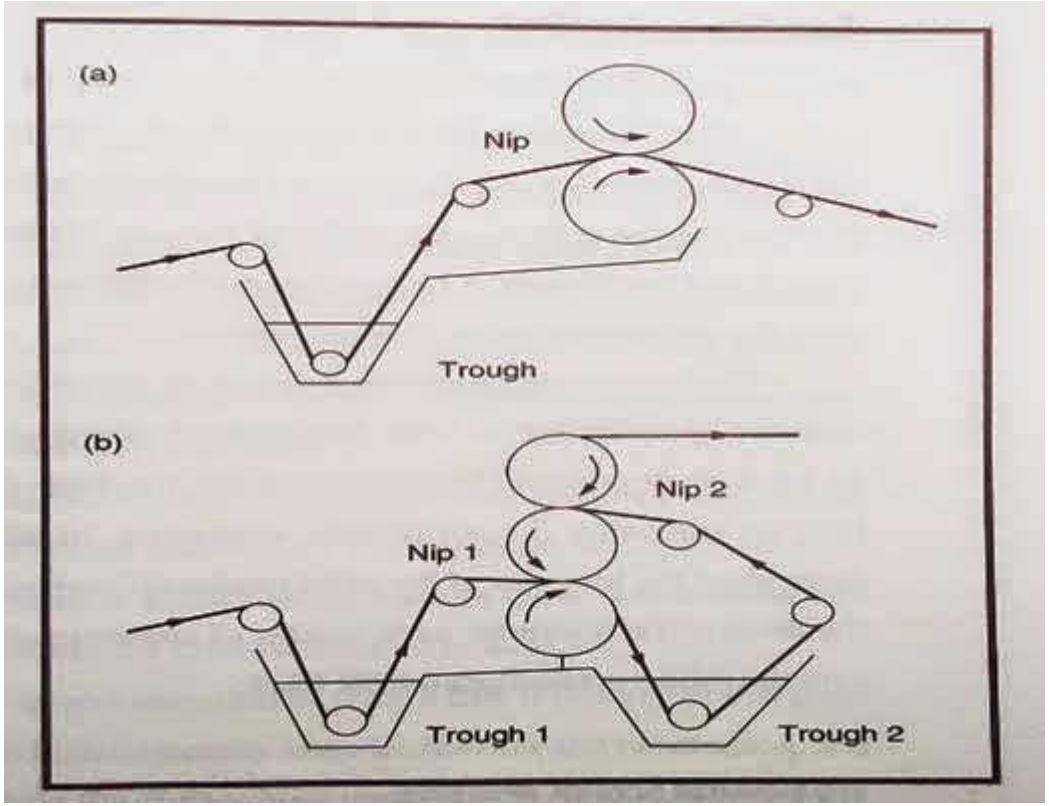
Continuous dyeing is the most popular method of dyeing woven fabrics. The characteristics of this dyeing method are the numerous rollers which grey fabrics go in and come out dyed.

When there is a large volume of goods, it is usually better to process them continuously without the inconvenience of separating the job into batches and repeating the process several times. In this situation processing is arranged as a continuous uninterrupted sequence of events from the start to finish. The goods move at a constant rate throughout and on completion of the dyeing they are taken up mechanically at the far end of the equipment. The process is run until the whole length of textile has passed through.

Although most continuous coloration is carried out on fabric, equipment is also available for dyeing fibre in the form of loose stock, tops and tow. At the start of each process fibre is sprayed with dye, fed on to an endless rubber belt and carried to the rollers of a padding mangle, where uniform impregnation is obtained as the surplus liquid is squeezed out. In the example shown in the following figure, the loose fibre is carried through a tubular steamer, washed to remove surplus dye bath ingredients and after the application of any special finishes, dried. This general scheme of impregnation followed by fixation, washing and drying is the same for each of the continuous process.



Various sequential operations are used for the continuous dyeing of fabric. An initial padding stage is common to all sequences. It involves immersion of the fabric in the dye liquor contained in a trough of minimal volume, which is kept constantly replenished from a stock tank. A liquor ratio is as low as 1:1 may be used; in general, low-substantivity dyes are used in continuous dyeing process. Next, the fabric passes in open width through a 'nip'. The nips are the padding mangle, in which heavy rollers (called bowls), pressed closely together along their length, and are rotated in opposite directions to carry the fabric through the system at a constant speed, squeezing out the superfluous dye liquor. Heavier fabrics are passed through two consecutive troughs and a second nip, using a three-bowl mangle.



The fabric, now uniformly impregnated with dye and the appropriate dye bath auxiliaries, usually passes directly to a steamer or dry heater for fixation. In some cases, however, where evaporation of the water in the fixation chamber causes unwanted directional migration of dye, the fixation step follows a preliminary drying operation. After fixing, the fabric passes from the fixing chamber to the washing range and is dried either on heated cylinders or by some other means such as radio frequency heating. Finally it is wound onto a beam ready for transportation. The sequence is similar for all processes, but of course the dyes, additives and operating temperatures vary from one situation to another.

Source: https://textileapex.blogspot.com/2015/02/continuous-dyeing-method.html

Different Continuous Methods of Dyeing

Dyeing:

Dyeing is the process of adding color to textile products like fibres, yarns and fabric. Main purpose of dyeing for achieving color with desired fastness. Dyeing can be done using dyes and pigments. Dyes can be used on vegetable, animal or man made fibers only if they have affinity to them. Dyeing process for different textile materials could be different but its basic idea is same for all. It can be done by hand or by machine. In this article I will discuss different continuous dyeing techniques.

Process flow path of dyeing

Recipe from dyeing lab

↓

Color preparation

↓

Dyeing

↓

Soaper

↓

Shade checking

Affinity of dyes to fibre:

As fibre vary in chemical structure so do dyes too have different chemical groups, all dyes do not have the same affinity for all fibres.

Substantivity:

The substantivity of a dye for a fibre can be defined as an attraction between the fibre and the dye under given dyeing conditions.

Exhaustion:

This is a measure of the proportion of dye absorbed by the fibre in relation to that remaining in the dye bath.

Dye uptake of different fibres:

- 8% for **cotton**
- 0.4% for polyester
- 13% for modal and viscose
- 13% for twill

Continuous dyeing methods:

Continuous dyeing methods are types. They are

1. Dyeing through E-control
2. Dyeing through CPB method

1. Dyeing through E-control:

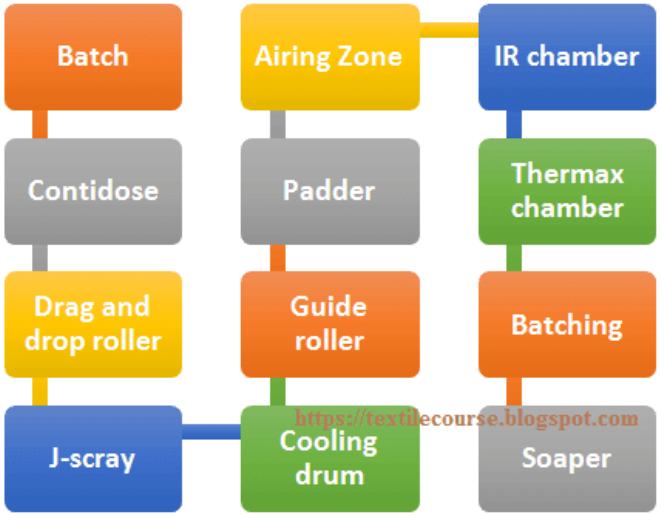


Fig: Process flow chart dyeing through E-control

Recipe for dyeing:

1. M:L = 4:1
2. Seravet CAS (wetting agent) = 2 gpl
3. Resist salt = 2 gpl
4. Seragel MIP (migrating agent) =10 gpl
5. Soda = 20 gpl
6. Caustic:
   a. Above 40 gpl = 12 ml
   b. Below 40 gpl = 5 ml

Machine used: Beninger

Threading length: 220m -230 m

Machine speed: Depends on the dwell time required for the thermax chamber and quality

Thermax setting:

Chamber	Temperature	Moisture	Exhaust	Humidity
1	120	50	13%	30
2	120	50	13%	30
3	120	50	13%	30

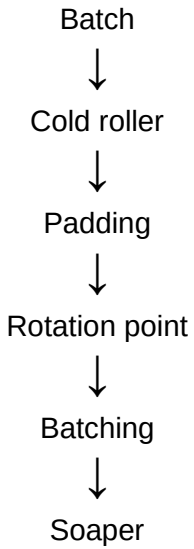
Procedure:

- Fabric comes to the entry J-scray from the batch through the contidose and drag and drop roller.
- Then the fabric comes to the cooling roller through guide roller.
- Now the fabric is padded in the padder. The padder is also connected to the trough having dyes and chemicals.
- Then through the mangle roller the fabric is squeezed. Nipper pressure should be maintained properly for uniform uptake of dye.
- Now the fabric comes to the airing zone, here the fabric comes in contact with the atmosphere, it also get the time for the penetration of the dye into the fabric.
- After airing zone the fabric comes to the IR chamber having LPG gas, here the fabric is partially dyed
- Then the fabric is passed to the thermax chamber for proper drying and fixation.
- Here steam does the work of exhaustion. Also 30% moisture is maintained in the steamer.
- Two types of temperature is used in steamer i.e. air temperature and steam temperature.
- Each chamber has 40 rollers. And total threading length of the steam chamber is 56m and each chamber length has 1.5mtr.

In thermosol process of dyeing, fabric is passed through IR to E-control. Temperature at IR is maintained at 210°c- 220°c. And E-control temperature is maintained at (130°c, 160°c and 190°c)

2. Dyeing through CPB method:

Process flow chart of CPB



Machine used: Bruckner

Fixation time: 8 hr, 12 hr, 16 hr

Speed in rotation point: 4rpm- 5rpm

Area of conditioning: 20°c-30°c

Recipe for dyeing:

1. M:L = 4:1
2. Seravet CAS (wetting agent) = 2 gpl
3. Resist salt = 2 gpl
4. Seragel MIP (migrating agent) =10 gpl
5. Soda = 20 gpl
6. Caustic:

a. Above 40 gpl= 12 ml

b. Below 40 gpl= 5 ml

Procedure:

- Fabric comes to the entry J-scray from the batch. Then the fabric is passed through the cold roller to padding unit.
- The fabric is then padded through the trough (which contains the dye and chemical solution).
- The capacity of the trough is 17l to 18l.
- Then through the mangle roller the fabric is squeezed. Nipper pressure should be maintained for uniform uptake of dye.
- Then the fabric is taken to the rotation point for fixation of dyes.
- Timing of rotation varies as 8hr, 12hr and 16hr.

Source: https://textilecourse.blogspot.com/2019/02/different-continuous-methods-dyeing.html

- **Continuous and semi-continuous dyeing: (BAT for the Textiles Industry, July 2003)**

In continuous and semi-continuous dyeing processes, the dye liquor is applied to the textile either by impregnation (by means of foulards) or by using other application systems. Most commonly, textiles are fed continuously in open width through a dip trough filled with dye liquor. The substrate absorbs an amount of dye solution before leaving the dip trough rollers that control the pick-up of the dye. Surplus stripped dye flows back into the dye bath.

Dye fixation is usually achieved in a subsequent stage using chemicals or heat (steam or dry heat). The final operation is washing, which is usually carried out in washing machinery at the end of the same line. The only difference between continuous and semi-continuous processes is the fact that in semi-continuous dyeing the application of the dye is performed continuously by padding, while fixation and washing are discontinuous.

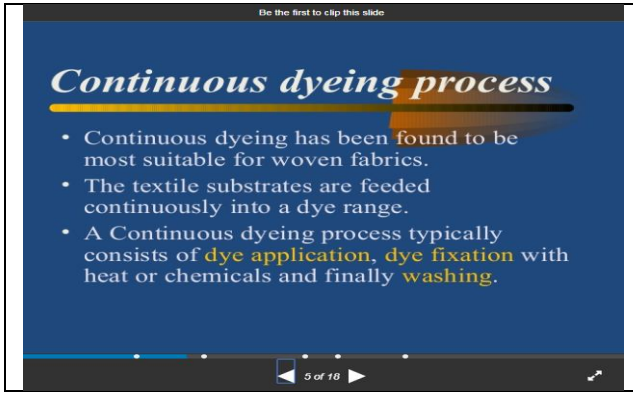
In continuous and semi-continuous processes the liquor ratio is not of practical importance and it is not used as a parameter. In these processes the factors to be taken into account are the wet pick-up %, i.e. grams of liquor picked up by 100 grams of substrate, and the concentration of the dye.

An overview of the most common techniques and machinery utilised in continuous and semi-continuous processes is given in Table 2.

Make-up		Process		Equipment
Woven & knitted fabric, tufted carpet	Rope	Continuous		Padding machine for piece in rope form + J-box or conveyor + washing machine
	Open-width	Semi-continuous	Pad-batch (or Carp-O-Roll for carpet)	Padding machine + washing machine
			Pad-roll (or Carp-O-Roll for carpet)	Padding machine + washing machine
			Pad-jig	Padding machine + jigger + washing machine
		Continuous	Pad-steam	Padding machine (1) + steamer + washing machine
			Pad-dry	Padding machine (1) + stenter frame + washing machine
			Thermosol	
Notes: (1) different applicators are used to dye carpets on continuous ranges (see also Section 10.4.2)				

Table 2 (Literature: IPCC-BAT for Textile Industry, EC 2003)

For more information please visit: http://wiki.zero-emissions.at/index.php?title=Dyeing_in_textile_industry



Presentation on Continuous dyeing

https://www.slideshare.net/Danish110/continuous-dyeing-machine

No.of slides: 18

Videos:

	Continuous dyeing and finishing machine https://www.youtube.com/watch?v=MvjLFrCoCL8 Duration: 00:01:36
	Dhall Continuous Dyeing & Thermosol Range at Mahavir Spinfab Kanpur https://www.youtube.com/watch?v=iFGn1P53kFE&t=158s Duration: 00:06:06
	Thermosol Dyeing Machine | The Continuous Dyeing Process https://www.youtube.com/watch?v=kAsbX9cRnv8&t=5s Duration: 00:02:56

TEXTILE WET PROCESSING

Module-10

LEARNER GUIDE

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 10: 0723001105 Carry out laboratory testing of dyeing process

Objective of the module: This competency standard covers the skills and knowledge required to perform laboratory tests like pH, tensile strength, color fastness and shrinkage to maintain quality of dyed fabrics.

Duration: 200 hours **Theory:** 40 hours **Practical:** 160 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Select textile substrate sample	**The trainee will be able to:** Select sample from marketing department for quality tests. Select sample during production for testing purpose.	Knowledge of textile substrate samples before the dyeing process and quality testing before dyeing. Knowledge of textile substrate samples during the dyeing process and quality testing during and after dyeing process.	Sample for dyeing
LU2: Perform Physical lab testing	**The trainee will be able to:** Calculate count of yarn as per given standard. Identify construction of fabric according to required parameters. Perform physical testing according to customers' requirement as follows: • pH of the fabric • Tear and tensile test of woven fabric • Seam slippage • Abrasion and Pilling test. • Snagging test • Sinking test (Absorbency) • Color fastness (light, water, perspiration, chlorine, rubbing, washing, saliva, PVC,) • Perform shrinkage test.	Indentifying the yarn, types of yarn, calculating the yarn count and types of yarn numbering system. Identifying the type of fabric with construction type. Differentiating the difference between knitted fabric and woven fabric. Knowledge of power of hydrogen (pH) and its effect on dyeing process. Knowledge of fabric testing like tear test, tensile strength test, seam slippage test, snagging test, abrasion and pilling test of woven fabrics. Importance of dimensional stability of fabric (shrinkage test) before and after dyeing. Importance of color fastness tests for dyed substrates and types of color fastness tests like light, water, perspiration, crocking (rubbing), chlorine and washing fastness tests according to international acceptable testing manuals (AATTC, ISO, ASTDM).	Hydro extractor Humidifier Scissor Manual of Quality tests Pantone book Xenon Lamp GSM Cutter Pilling Tester Weighing scale Pick glass Light Box Data Color Crock meter IR Lamp Fado meter Iron Grey Scale Tongue T-Square Marker Scale

	• Perform shade matching • Fabric GSM testing • Perform Berger whiteness test • Perform Barium activity number test	Identifying shade and knowledge of shade matching and shade variations with shade consistency. Knowledge and importance of Berger whiteness test. Importance and usage of Barium activity number test.	Blue Scale Launder-o-meter Tensile strength tester Tear tester Ring Wrapping reel Snagging tester machine
LU3: **Perform Chemical Testing**	**The trainee will be able to:** Perform chemical testing as per standard. Check Water hardness through water hardness test Perform sizing chemical test (TEGWA test) Perform dyestuff testing as per standard (dyes identification testing) Test dyes and chemicals batch-wise.	Importance of chemical testing during dyeing process. Knowledge of water hardness (TDS) test before dyeing and during dyeing process and its effect on dye pick-up quality. Knowledge of sizing chemical test (TEGWA) and its effect on dyeing process. Identifying the dyestuff and its tests with required standards. Testing of chemicals strength, properties and auxiliaries used for dyeing process.	Multi fibre Wash Tech pH meter pH Strips Baume' meter TDS meter Stop Watch Beakers Pippets Pad steam Padder Burner Flame tester Glass Rod Stirrer Conical flask PPEs Spatula IR Dyeing machine Tumble dryer Filter paper
LU4: Verify final results	**The trainee will be able to:** Determine the evaluation criteria of the tests. Evaluate the testing result according to the defined quality standards Settle machine and dyeing	Verifying an evaluating the test criteria according to international standards as per defined in AATTC, ISO, ASTM methods. Matching the test results according to dyeing plan and quality standards. Setting of machine and dyeing parameters according to test results for dyeing process as per customers'	AATCC Manual ISO Manual ASTM Manual

	parameters according to quality testing results	requirement.	
LU5: **Maintain Quality Records**	**The trainee will be able to:** Record batch-wise testing reports (dyes and chemical) on daily basis. Coordinate with concerned person regarding production batches. Maintain record on daily basis.	Recording and maintain the dyes and chemical test results for upcoming batches for dyeing process. Coordinating with concerned persons for running batches at dyeing floor regarding production with standards. Maintaining the records of tests on daily basis on register.	Computer Printer Stationary

Images of dye samples:

Yarn Numbering System

Yarn Number

Yarn number is a measure of the fineness or size of a yarn expressed either as mass per unit length or length per unit. Yarn Count and Yarn Size are synonymous with Yarn Number.

Yarn Numbering System

There are two systems of expressing yarn number or yarn count.

1. Direct yarn numbering system (mass/unit length)
2. Indirect yarn numbering system (length/unit mass)

Direct yarn numbering system

In a direct yarn counting system, the yarn number or count is the **weight** of a **unit length** of yarn. This means the higher the yarn count number, the heavier or thicker the yarn. It is fixed length system. This system is generally used for jute or silk yarn.

The following formula is used to calculate direct yarn count system.

$$N_d = \frac{W \times l}{L}$$

Where, w=yarn number or count

W=the weight of the sample (yarn) in units of the system at the official regain

L=length of the sample, and

l=unit of length of the system

Major direct numbering System

Denier: In the direct Denier system, the yarn count number indicates “the weight in grams of 9000 meters of yarn”.
e.g. 30D indicates that 9000 meters of yarn weight 30 grams.

$$Denier = \frac{9000 \times Grams}{Meters}$$

Tex: In the direct universal Tex system, the yarn count number indicates "the weight in grams of 1000 meters of yarn".

e.g. 30 Tex indicates that 1000 meters of yarn weight 30 grams.

$$Tex = \frac{1000 \times Grams}{Meters}$$

Dtex: In the direct Decitex system, the yarn count number indicates "the Adobe Illustrator weight in grams of 10000 meters of yarn". (1 dtex=0.9 denier)

e.g. 50 Tex indicates that 1000 meters of yarn weight 30 grams.

$$dtex = \frac{10000 \times Grams}{Meters}$$

Math: If a skein of 100 m of filament Viscose Yarn weight is 1.67 g, calculate its Denier.

Solⁿ: In the Denier system the weight unit is the gram and the unit of length is 9000 m.

Thus, W=1.67 g, L=100 m, and = 9000 m.

$$We\ know, N_d = \frac{l \times W}{L}$$

$$Therefore, Denier = \frac{l \times W}{L} = \frac{9000 \times 1.67}{100} = 150.3\ denier$$

So the yarn count is 150.3 D.

Indirect yarn numbering or counting system

In an indirect yarn counting system, the yarn number or count is the number of "**units of length"** per "**unit of weight"** of yarn. This means the higher the yarn count number, the finer or thinner the yarn. It is based on the fixed weight system. This system is generally used for cotton, woolen, worsted and linen yarn.

The following formula is used to calculate indirect yarn count system.

$$N_{id} = \frac{L \times w}{l \times W}$$

Where, N_{id}=yarn number or count in indirect system

W=the weight of the sample (yarn) in units of the system at the official regain
w=unit of weight of the system
L=length of the sample, and
l=unit of length of the system

Major indirect numbering or counting System

English Cotton Count (Ne): In the indirect English cotton count system, the yarn count number indicates "number of 840 yard hanks of yarn per 1 pound weight".

e.g. 30/1 cotton(1 means single yarn) indicates that 30 x 840 yards of yarn weight 1 pound.

e.g. 40/2's (2 means ply yarn) indicates that 20(Resultant count)x 840 yards of yarn weight 1 pound.

$$Cotton\ count,\ Ne = \frac{Yards}{840 \times Pounds}$$

Metric Count (Ne): In the indirect metric count system, the yarn count number indicates "number of 1000 m (or 1 Km) of yarn per 1 Kg weight".

e.g. 30 Nm indicates that 30 kilometers or 30000 meters of yarn weight 1 kilogram.

$$Metric\ count,\ Nm = \frac{meter}{1000 \times Kilogram}$$

For example, if we consider a yarn of 2000m having the weight of 450g. So the count in metric system will be

$$Metric\ count, Nm = \frac{2000}{1000 \times\ 0.45}$$

=4.4 Nm

Worsted Count: In the indirect worsted count system, the yarn count number indicates "number of 560 yards hanks of yarn per 1 pound weight".

e.g. 1/20 worsted indicates that 20 x 560 yards of yarn weight 1 pound.

e.g. 3/40 worsted indicates that 13.33(Resultant count)x560 yards of yarn weight 1 pound.

$$Worsted\ Count, Nw = \frac{Yards}{560 \times Pound}$$

Indirect Numbering System Table

S.N	Name of the system	Unit of Length(l)	Unit of Weight(w)
01	English count(Ne_c)	840 yards(hank)	1 pound
02	Metric Count(Nm)	1 km	1 kg
		496 yards	1 pound
03	Woolen [Yorkshire] (Ny)	256 yards(skein)	1 pound
04	Woolen Run [American] (WR)	1600 yards(run)	1 pound
05	Woolen Cut [Galashiels] (WC)	200 yards(cut)	1 pound
		300 yards(cut)	24 ounces
06	Worsted count (Nw)	560 yards(hank)	1 pound
07	Linen[wet-spun](Ne_L)	300 yards(lea)	1pound

e.g. 50 Nm Metric indicates that 50 x 256 yards of yarn weight 1 pound.
e.g. 15 cut Galashiels indicates that 15 x 200 yards of yarn weight 1 pound.
e.g. 16 skeins Yorkshire indicates that 16 x 256 yards of yarn weight 1 pound.
e.g. 10 lea Linen indicates that 10 x 300 yards of yarn weight 1 pound.

Note: Woolen and Worsted Systems-The basic difference between the two is that in the Worsted system all short fibers are removed and the remaining long ones are aligned parallel. In the Woolen system there is no removal of short fibers, so some fibers lie parallel and others randomly.

Math: A lea (120 yd) of cotton yarn weighs 25 gr, calculate its count in the cotton system.

Soln: In English cotton count system, the 'unit of length' is the hank (840 yd) and the 'unit of weight' is 1 lb. In 1 lb there are 7,000 grains.

Hence, L =120 yd, =840 yd, W=25/7,000 lb, and w=1 lb

For more information plz visit: https://textilestudycenter.com/yarn-numbering-system/

Identification of Textile Fiber | Fiber Test for Identification

There are many methods available for identification of the structural, physical, and chemical properties of fibers. Various methods are used for fibre identification like microscopic methods, solubility, heating and burning method, density and staining etc. End-use property characterization methods often involve use of laboratory techniques which are adapted to simulate actual conditions of average wear on the textile or that can predict performance in end-use.

Fig: Textile fiber burning test

TYPES OF TEXTILE FIBER TEST

The Non technical Test

1. FEELING TEST
2. BURNING TESTS

The Technical Test

1. MICROSCOPIC TEST

2. CHEMICAL TEST

Tests for identification

1. Handle/Feel Test
2. Visual Examination
3. Burning test
4. Twist on Drying
5. Floatation Test
6. Microscopic analysis
7. Chemical Analysis

Requirements for tests:

1. Preparation of test specimen
2. Apparatus for microscopic examination
3. Reagents used for chemical tests
4. Other tools and equipment

THE NON-TECHNICAL TESTS

1. Feeling test
2. Burning test

FEELING TEST

- The feeling test requires perception if it is to be of any value.
- Skilled perception is acquired only after handling many different fabrics over a period of time.
- Limitations of this test become apparent when examining and comparing fabrics of different fiber content.

BURNING TEST

To recognize the composition of fabrics by the burning test ,the sample of fibre, yarn of fabric should be moved slowly towards a small flame and the reaction to heat carefully observed .One end of the sample should be put directly into flame to determine its burning rate and characteristics. The burning odour should be noted and the characteristics of the ash such as amount , form, hardness and colour should be examined.

TECHNICAL TESTS

There are certain technical tests performed for identifying various fibers. These tests req uire high technology laboratory equipment a nd are much more reliable than the non tech nical fibre tests. Technicals tests require high skilled personn el and technical know how of handling chemi cals and their accurate analysis. These tests are very valuable for those fabrics that are a blend of different yarns and also have certai n special properties including flame retardan ce etc.

TYPES OF TECHNICAL TEST

1. Microscopic test
2. Chemical test

MICROSCOPIC TEST

1. Microscopic test is a technical test that involves identifying the fabric with the help of a microscope with a magnification of minimum 100 power.
2. The test can easily distinguish between fibers.
3. The test identifies the natural fibers more easilyas compared to man made ones.
4. Synthetic fibers are very similar in appearanceand the increase in the number of varieties, makes it a little tough to distinguish the fibers even under a microscope.

CHEMICAL TESTS

1. Chemical tests are another technical means of identifying fibers. But chemical tests are not intended for the general consumers. Different types of chemical tests are undertaken to establish the identity of the fibers used.
2. These tests give accurate and precise analysis.
3. The tests are conducted in research laboratory

Source: https://textilelearner.blogspot.com/2011/08/identification-of-textile-fiber-fiber.html

Dye | Classification of Dye According to Application

Dye:

By definition dyes can be said to be coloured, ionizing and aromatic organic compounds which shows an affinity towards the substrate to which it is being applied. It is generally applied in a solution that is aqueous. Dyes may also require a mordant to better the fastness of the dye on the material on which it is applied. The dyes were obtained from animal, vegetable or mineral origin with no or very little processing. By far the greatest source of dyes has been from the plant kingdom, notably roots, berries, bark, leaves and wood, but only a few have ever been used on a commercial scale.

Different dyes

Classification of Dye According to Application

1. Reactive Dyes
2. Acid Dyes
3. Premetallized Dyes
4. Direct Dyes
5. Azoic (Napthol) Dyes
6. Disperse Dyes

7. Vat Dyes
8. Sulfur Dyes
9. Basic Dyes

1. REACTIVE DYES

Reactive dyes are the most recent of dyes. These are the most popular in the world among fibre and fabric artists, used at first only by surface designers, but recently by weavers as well. There are now reactive dyes for a wide range of fibres, e.g. cotton (PROCION), silk and wool (PROCILAN). The dye actually reacts with the fibre molecules to form colour and is, as a result, extremely fast to both light and washing. There are hot and cold water reactive dyes, in fact there is a dye for almost every need. They can be most successfully used for silk painting, with a much better colour fastness than the traditional basic dyes, and are already used by batik artists. we can identify a reactive dye by the alkali used to set off the fixation process, which requires time to take place (silk and wool reactives uses acetic acid). Assistants used are salt, soda ash and resist salt, and sometimes bicarbonate of soda and urea. Reactive dyes are equally suited to screen printing polychromatic printing, fabric painting yarn and piece dyeing.

2. ACID DYES

These are acidified basic dyes, intended for use on protein fibres but can be used on nylon and acrylics. They have a fair light fastness but poor wash fastness

3. PREMETALLIZED DYES

These are an acid dyes with the addition of one or two molecules of chromium. The dyesgive mutetonings, not unlike those of natural dyes. They are the synthetic dyes mostly used by weavers who dye their own yarns.

4. DIRECT DYES

These substantive dyes colour cellulose fibres directly in a hot dyebath without a mordant, to give bright colours. They are not very fast to light or to washing. Direct dyes are generally any dyes which use salt as their only fixative, e.g. Dylon dyes (not to be confused with reactive dyes, which use salt plus other chemicals).

5. AZOIC (NAPHTHOL) DYES

These are another sort of direct dye, but ones that are extremely fast to washing, bleach and light. They are intended for cellulose fibres and can be used successfully on protein fibres, although the colours are different. These dyes are widely used all over Asia and Australia for batik and direct application. They can be used to give interesting texture colour effects on fabric, thread or paper. Their use for straight silk painting is minimal because of the difficulty in achieving evenness of painted colour.

6. DISPERSE DYES

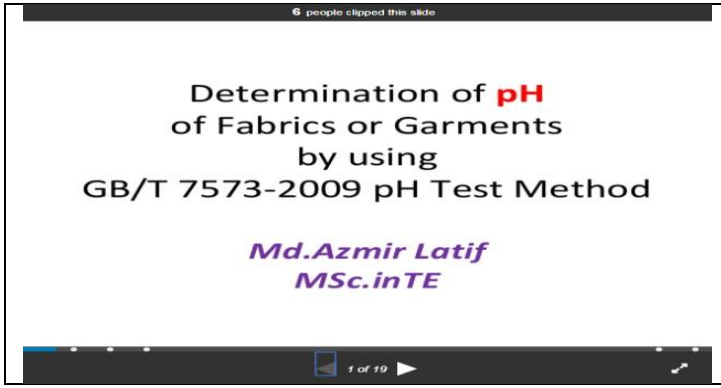
Originally developed for acetate fibres, these are now the major dyes for synthetics. They are not soluble in water, but in the actual fibres themselves. They require a carrier to swell the fibres so that the finely ground particles can penetrate. They are dyed hot, like direct dyes, but do not use salt. Disperse dyes are widely used for heat transfer printing (Polysol). Dye is printed or painted onto paper and heat pressed onto fabric. Prints have excellent light and wash fastness and strong bright colours. Their major disadvantage is that only synthetic fabrics can be used.

7. VAT DYES

Vat dyes are the fastest for cellulose fibres. The dye is made soluble with alkali, put in a 'vat' with a reducing agent, usually sodium hydrosulphite, which removes all oxygen from the liquid, and the fabric is dyed, then oxidized in the air to achieve the true colour. Synthetic indigo is a characteristic vat dye, but there are many colours available

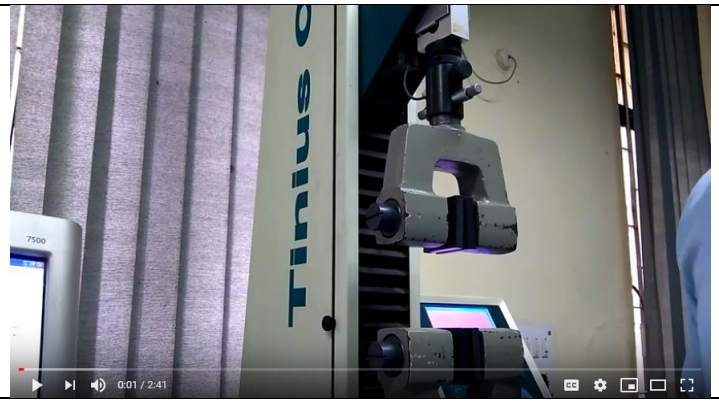
8. BASIC DYES

The colours are very bright, but not very fast to light, washing, perspiration. Fastness is improved if they are given an after-treatment or steaming, e.g. French Silk dyes are basic dyes and should be steamed to fix.

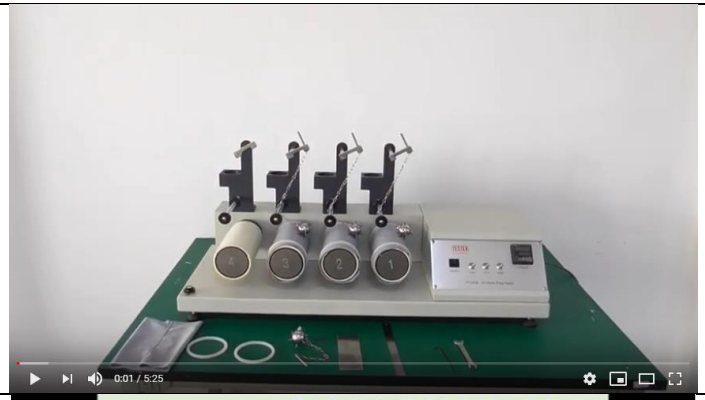
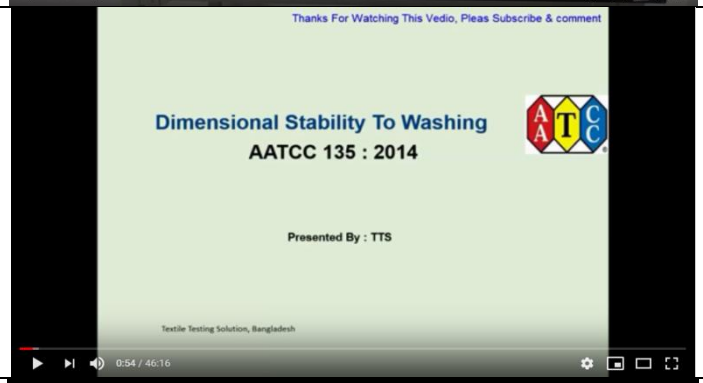
	Presentation on pH of fabric https://www.slideshare.net/88azmir/a-determine-ph-of-fabric-or-garments Slides: 19

Videos:

	How to check tear strength of any woven fabric. https://www.youtube.com/watch?v=AAgjF6WV0K4 Duration: 00:05:29

	Tensile testing of fabric https://www.youtube.com/watch?v=wJzDTwp22Ao Duration: 00:02:41

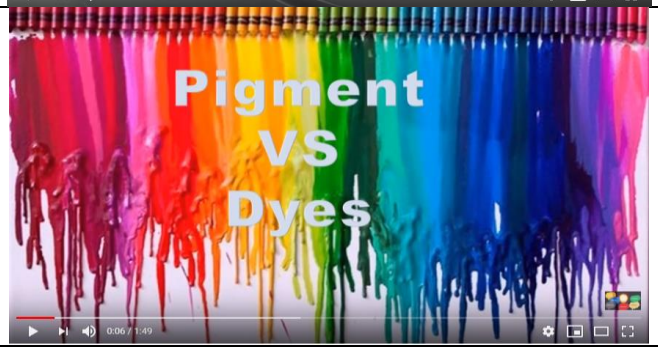
	Tinius Olsen 5ST Textile Seam Slippage Test https://www.youtube.com/watch?v=jmIpauaJ-pc Duration: 00:02:15
	Martindale Abrasion Tester, Martindale Pilling Tester, Martindale Abrasion and Pilling Tester https://www.youtube.com/watch?v=-UBR19OR7u0 Duration: 00:07:00

		TF220 ICI Mace Snag Tester https://www.youtube.com/watch?v=uZG6__Gdl2w Duration: 00:05:25
		AATCC 135 Tutorial In Bangla Dimensional stability (Shrinkage test) https://www.youtube.com/watch?v=l7wvQnCxsIQ Duration: 00:46:16
		Fabric Burn Test https://www.youtube.com/watch?v=-SriB05FLU4 Duration: 00:10:25

		AATCC Color Fastness to Water ISO https://www.youtube.com/watch?v=5pAzjmaAfSU Duration: 00:09:28
		Color Fastness to Perspiration Test (Acid, Alkali), ISO 105 E04 https://www.youtube.com/watch?v=NhkfWPUuZjY Duration: 00:07:46
		Color Fastness to Rubbing Test https://www.youtube.com/watch?v=z7_Ho6J1cVY Duration: 00:02:27

		Textile Lab Test Result by Grey Scale. https://www.youtube.com/watch?v=sbPT811zg50 Duration: 00:07:08
		Fabric pH test, ISO 3071 https://www.youtube.com/watch?v=zGsQ4Kq1txA Duration: 00:04:16
		Fabric Color Matching https://www.youtube.com/watch?v=2nZTZkL4384 Duration: 00:05:22

	How to find GSM OF FABRIC https://www.youtube.com/watch?v=8W-fEJejLuc Duration: 00:01:40
	Barium Identification Test Cation Salt Analysis https://www.youtube.com/watch?v=Xj43RcIqpWg Duration: 00:03:53
	Measuring water hardness https://www.youtube.com/watch?v=C-MvNfo4CgQ Duration: 00:01:44

		Tips for Testing Fabric Content https://www.youtube.com/watch?v=oDXOl4UbSqU&t=213s Duration: 00:05:41
		Pigment vs dye♣Basic difference between pigment & Dyes♣What is pigment?♣ What is Dyes? https://www.youtube.com/watch?v=MD-OLSRgmWg Duration: 00:01:49

Module Summary:

Module Title and Aim	Learning Units	Timeframe of modules
Module 1: Apply Work Health and Safety Practices (WHS) **Aim:** The Aim of this module is to work with safety and participate in hazard assessment activities, follow emergency procedures and participate OHS practices in process.	LU1: Implement safe work practices at work place LU2: Participate in hazard assessment activities a work place LU3: Follow emergency procedures at workplace LU4: Participate in OHS consultative processes	30
Module 2: Identify and Implement Workplace Policy and Procedures **Aim:** The aim of this module is to develop and implement a workplace policy & procedures and to modify the policy to suit changed circumstances. It applies to individuals with managerial responsibilities who undertake work developing approaches to create, monitor and improve strategies and policies within workplaces and engage with a range of relevant stakeholders and specialists.	LU1: Identify workplace policy & procedures LU2: Implement workplace policy & procedures LU3: Communicate workplace policy& procedures LU4: Review the implementation of workplace policy & procedures	20
Module 3: Communicate at Workplace **Aim:** This aim of this module is to develop communication skills in the workplace. It covers gathering, conveying and receiving information, along with completing assigned written information under direct supervision.	LU1: Communicate within the organization LU2: Communicate outside the organization LU3: Communicate effectively in workgroup LU4: Communicate in writing	30

Module Title and Aim	Learning Units	Timeframe of modules
Module 4: Perform Computer Application Skills **Aim:** The aim of this module is to use spreadsheet applications, prepare in page documents, develops familiarity with Word, Excel, Access, PowerPoint, email, and computer graphics basics. It applies to individuals who perform a range of routine tasks in the workplace using a fundamental knowledge of spreadsheets, Microsoft office and computer graphics in under direct supervision or with limited responsibility.	LU1: Prepare In-page documents as per required information LU2: Prepare Spreadsheets as per required information LU3: Use MS Office as per required information LU4: Perform computer graphics in basic applications LU5: Create Email account for communications	40
Module 5: Manage Personal Finances **Aim:** The aim of this module is to manage develop, implement and monitor a personal budget in order to plan regular savings and manage debt effectively.	LU1: Develop a personal budget LU2: Develop long term personal budget LU3: Identify ways to maximize future finances	30
Module 6: Carry out Exhaust Dyeing for Woven Fabrics. **Aim:** The aim of this module is to perform the dyeing parameters for dyeing fabrics by the exhaustion process in accordance with the dyeing plan and to ensure color matching to the required quality standards.	LU1: Follow Dyeing Plan for woven fabric dyeing by exhaust process LU2: Prepare and ensure woven fabric dyeing parameters for exhaust dyeing LU3: Identify shade by using shade matching method for woven fabrics LU4: Perform Dyeing LU5: Verify quality of woven fabric dyeing by exhaust process LU6: Prepare production report for woven fabric dyeing by exhaust process	80

Module Title and Aim	Learning Units	Timeframe of modules
Module 7: Carry out Exhaust Dyeing for Knitted Fabrics. **Aim:** The aim of this module is to prepare and ensure dyeing parameters for knitted fabric dyeing by exhaust method according to dyeing plan with skills of shade matching under the required quality standards.	LU1: Follow Dyeing Plan for knitted fabric dyeing by exhaust process LU2: Prepare and ensure knitted fabric dyeing parameters for exhaust dyeing LU3: Identify shade by using shade matching method for knitted fabrics LU4: Perform Dyeing LU5: Verify quality of knitted fabric dyeing by exhaust process LU6: Prepare production report for knitted fabric dyeing by exhaust process	80
Module 8: Carry out Semi-Continuous Dyeing **Aim:** The aim of this module is to prepare and ensure dyeing parameters for fabric dyeing by semi-continuous dyeing method according to dyeing plan with skills of shade matching under the required quality standards.	LU1: Follow Dyeing Plan for semi-continuous dyeing LU2: Prepare and ensure dyeing parameters for semi-continuous dyeing LU3: Identify shade by using shade matching method for semi-continuous dyeing. LU4: Perform Dyeing LU5: Verify quality for semi-continuous dyeing process LU6: Prepare production report for semi-continuous dyeing process	80
Module 9: Carry out Continuous Dyeing **Aim:** The aim of this module is to prepare and ensure dyeing parameters for fabric dyeing by continuous dyeing method according to dyeing plan with skills of shade matching under the required quality standards..	LU1: Follow Dyeing Plan for continuous dyeing LU2: Prepare and ensure dyeing parameters for continuous dyeing LU3: Identify shade by using shade matching method for continuous dyeing. LU4: Perform Dyeing LU5: Verify quality for continuous dyeing process LU6: Prepare production report for continuous dyeing process	80
Module 10: Carry out laboratory testing of dyeing process **Aim:** The aim of this module is to perform laboratory tests like pH, tensile strength, color fastness and shrinkage to maintain quality of dyed fabrics.	LU1: Select textile substrate sample LU2: Perform Physical lab testing LU3: Perform Chemical testing LU4: Verify final results LU5: Maintain Quality Records	200

Test Yourself (Multiple Choice Questions)

Question	Candidate's answer
1. The term RFD (Ready for dyeing) means?	A RFD fabric refers to a white fabric that was processed through scouring and bleaching to remove starches, sizing or finishes applied to the fabric which could interfere with the dyeing. Scouring is done to improve dye uptake and absorption into the fabric and improve evenness in dyeing throughout the fabric length.
2. Choose right sequence of steps for exhaust dyeing method for woven fabrics?	a. Dissolving and dispersion of dye –Diffusion – Migration - Adsorption b. Dissolving and dispersion of dye – Adsorption – Diffusion – Migration c. Dissolving and dispersion of dye – Adsorption – Migration - Diffusion d. Dissolving and dispersion of dye – Diffusion – Migration Adsorption
3. Write down any FIVE dyeing auxiliaries used for exhaust dyeing?	23. Sequestering agent 24. Lubricants / Anti-creasing. 25. Pretreatment Chemicals 26. Peroxide killer 27. Leveling Agent. 28. Sequestering, Dispersing and Leveling Agent for Reactive dyeing. 29. Antifoam. 30. Salt/Electrolyte 31. Carrier
4. Washing fastness of fabric dyed with direct dyes is _____?	a) Poor b) Good c) Very Good d) Excellent
5. Temperature must be maintain at _____ for dyeing of fabric with direct dyes through exhaust method?	1. 10 ^{o}C 2. 20 ^{o}C 3. 30 ^{o}C 4. 40 ^{o}C

Question	Candidate's answer
6. Pantone Book is used for _____?	a) Dye preparation b) Shade matching c) Samples of dyes d) Fastness results
7. The main auxiliaries in dyeing sequestering agents are used to remove _____.	a) Dust b) Neps c) Hardness of water d) Starch from fabric
8. How many classes of direct dyes?	a) 2 b) 3 c) 4 d) 5
9. Dispersing agent help to increase _____of disperse dye in water.	a. Solubility b. Bright color c. Hardness d. quality
10. _____ is an organic compound which helps to take up dye at lower temperature and pressure over the textile material.	a) Lubricant b) Hydrogen peroxide c) Sulphuric Acid d) Carrier
Question	**Candidate's answer**

Question	Candidate's answer
11. What is running shade?	Running shade is more specifically meter to meter variation of shade in fabric. So, basically when dyes cannot migrate properly in the whole fabric thus exhaustion of dyes in fabric becomes uneven which leads to running shade or uneven dyeing.
12. Write down any THREE knit fabric problems during preparation, dyeing and after treatment?	1. edge mark 2. crease mark 3. pin hole 4. loss of fabric strength 5. shade variation of batch-to-batch 6. uneven dyeing 7. patchy, 8. colour spot 9. white spot 10. meter to meter shade variation 11. hand feel problem 12. fastness problems
13. Write down any FIVE causes of running shade?	11. Lack of proper combination of dyes 12. Not maintaining exact dyeing process 13. Lack of proper amount of salt and alkali dosing 14. Lack of quality products and proper products in the bath 15. Lack of proper alkali dosing 16. Lack of proper pretreatment 17. Not selecting good leveling agent 18. Lack of awareness for water quality 19. Not maintaining proper machine and material operation by the operator 20. Lack of proper after treatment
14. Washing fastness of fabric dyed with reactive dyes is _____?	e) Very Poor f) Poor g) Good h) Very Good

Question	Candidate's answer
15. Knit fabric is prepared through?	5. Projectile 6. Knitting machine 7. Weaving machine 8. Embroidery machine
16. Pantone Book is used for _____?	e) Dye preparation f) Shade matching g) Samples of dyes h) Fastness results
17. What are meaning of dyeing auxiliaries?	Dyeing auxiliaries mean a chemical or formulated chemical product which enables a processing operation in preparation, dyeing, printing or finishing to be carried out more effectively, or which is essential if a given effect is to be obtained. Main functions of dyeing auxiliaries to prepare the substrate for coloration, to stabilize the application medium, to increase the fastness properties of dyeing, to modify the substrates etc.
18. RFD (Ready for Dyeing) fabrics are created by processing _____fabrics?	e) finished f) Greige g) dyed h) printed
19. Define theory of Dyeing?	The dyeing process is a chemical reaction occurring between the dye molecule and the fibre molecule:
20. Plain, twill, rib, fleece, interlock, pique are types of _____.	e) fibre f) cotton yarn g) polyester yarn h) Fabric

Question	Candidate's answer
21. Define Pad Batch process?	Pad Batch Dyeing is one of the widely used technique for semi-continuous dyeing process. It is mainly used in the dyeing of cellulosic fibre like cotton or viscose (knit and woven fabric) with reactive dyes.
22. Disperse dyes may be applied on ----------fibres?	13. Natural 14. Animal 15. Vegetable 16. Synthetic
23. Vat, Sulphur, Reactive, Disperse and Acid are the types of _____.	21. Dyes 22. Chemicals 23. Auxiliaries 24. Quality Tests
24. _____ dyes may be applied on wool, silk, paper, synthetic fibre sans leather materials / substrates?	i) Direct j) Acid k) Azoic l) pigment
25. Polyester fabric can be dyed with_____?	9. Disperse dyes 10. Reactive dyes 11. Basic dyes 12. Vat dyes
26. Dyeing Technologist uses and refer _____ for shade preparation?	i) Greige scale j) Blue scale k) AATCC manual l) Pantone Book

Question	Candidate's answer
27. Thiourea dioxide , sodium bisulfite, sodium formaldehyde sulfoxylate, sodium hydrosulfite are the types of _____agents.	1. Anti-foaming 2. Anti-creasing 3. Dispersing 4. Reducing
28. Define Salt and its main use for dyeing?	An ionic compound that is formed by a neutralization reaction (reaction of an acid with a base). The best known salt, common salt, or sodium chloride (NaCl) is extensively used as an electrolyte in dyeing.
29. Abbreviation of pH is power of _____?	a) Hydrogen b) Hydrogen peroxide c) Helium d) Hydro sulphite
30. Tick the right sequence of semi-continuous dyeing process?	i) Padding-batching-washing j) Batching-padding- washing k) washing -batching-padding l) Padding- washing-batching
Question	**Candidate's answer**
31. _____ is the type of continuous dyeing machine.	a) Pad Batch b) Pa Steam c) Jigger d) Winch

Question	Candidate's answer
32. Reactive dyes may be applied on _____fibres?	17. Cotton 18. Nylon 19. Polyester 20. Synthetic
33. Alkali, Acid, Salt, Carries, are types of _____.	a) Dyes b) Fibres c) Auxiliaries d) Quality Tests
34. Enlist any THREE properties of good fixing agents for fixation of dyes on substrates?	1) good capability with cross linking agents without promoting yellowing effect 2) good leveling 3) good migration 4) does not affect the shade 5) good affinity for the fiber 6) stable to steaming and dry heat 7) improved all round fastness
35. The dispersing agent is used to assist the disperse dye to solubilize in water so that the dye molecule can be transferred from the dye bath to the _____.	13. Water 14. Chemicals 15. Dyes 16. Textile substrate
36. Dyeing Technologist uses and refer _____ for shade matching?	m) Greige scale n) Blue scale o) J- Box p) Light Box

Question	Candidate's answer
37. In continuous and semi-continuous dyeing methods the term "wet pick-up %age" does means?	In continuous and semi-continuous processes the liquor ratio is not of practical importance and it is not used as a parameter. In these processes the factors to be taken into account are the wet pick-up %, i.e. grams of liquor picked up by 100 grams of substrate, and the concentration of the dye.
38. _____ agents prevent di- and tri-valentmetal ions from interfering with the chemical processing of the textile material?	e) Sequestering f) Leveling g) Reducing h) Dispersing
39. Sodium hydroxide and Potassium hydroxide are types of_____.	a) Carries b) Salt c) Alkalis d) Leveling agents
40. Why continuous dyeing is most popular?	Continuous dyeing is the most popular method of dyeing woven fabrics. The characteristics of this dyeing method are the numerous rollers which grey fabrics go in and come out dyed.
Question	**Candidate's answer**
41. Define Yarn Count / Yarn Number?	Yarn number is a measure of the fineness or size of a yarn expressed either as mass per unit length or length per unit. Yarn Count and Yarn Size are synonymous with Yarn Number.

Question	Candidate's answer
42. Enlist any THREE methods of fibre identification?	21. microscopic method 22. solubility methods 23. heating methods 24. density methods 25. staining methods 26. feeling methods
43. _____ dyes are acidified basic dyes, intended for use on protein fibres but can be used on nylon and acrylics.	e) Sulphur f) Reactive g) Acid h) Vat
44. Enlist any THREE properties of good fixing agents for fixation of dyes on substrates?	8) good capability with cross linking agents without promoting yellowing effect 9) good leveling 10) good migration 11) does not affect the shade 12) good affinity for the fiber 13) stable to steaming and dry heat 14) improved all round fastness
45. Write down intro of Basic dyes.	Basic Dyes: The colors are very bright, but not very fast to light, washing, perspiration. Fastness is improved if they are given an after-treatment or steaming, e.g. French Silk dyes are basic dyes and should be steamed to fix.
46. AATCC, ISO and ASTM are international standards for _____ quality control tests.	q) Dyeing r) Printing s) Textile t) Management

Question	Candidate's answer
47. Crock meter is an instrument responsible to check rating of fabric _____ fastness.	a) Dyeing b) Printing c) Management d) Textile
48. _____ agents prevent di- and tri-valentmetal ions from interfering with the chemical processing of the textile material?	i) Sequestering j) Leveling k) Reducing l) Dispersing
49. Spectrophotometer is used for _____?	e) Dye preparation f) Chemical preparation g) Recipe preparation h) Shrinkage control
50. If rating of color of red fabric according to grey scale is 5 by crock meter, it means _____ rubbing fastness of fabric.	a) Excellent b) Very Good c) Good d) Poor

Frequently Asked Questions

1. What is Competency Based Training (CBT) and how is it different from currently offered trainings in institutes?	Competency-based training (CBT) is an approach to vocational education and training that places emphasis on what a person can do in the workplace as a result of completing a program of training. Compared to conventional programs, the competency based training is not primarily content based; it rather focuses on the competence requirement of the envisaged job role. The whole qualification refers to certain industry standard criterion and is modularized in nature rather than being course oriented.
2. What is the passing criterion for CBT certificate?	You shall be required to be declared “Competent” in the summative assessment to attain the certificate.
3. What are the entry requirements for this course?	The entry requirement for this course is 8th Grade or equivalent.
4. How can I progress in my educational career after attaining this certificate?	You shall be eligible to take admission in the National Vocational Certificate Level-3 in Textile Wet Processing (Dyeing Technologist). You shall be able to progress further to National Vocational Certificate Level-4; and take admission in a level-5, DAE or equivalent course. In certain case, you may be required to attain an equivalence certificate from The Inter Board Committee of Chairmen (IBCC).
5. If I have the experience and skills mentioned in the competency standards, do I still need to attend the course to attain this certificate?	You can opt to take part in the Recognition of Prior Learning (RPL) program by contacting the relevant training institute and getting assessed by providing the required evidences.
6. What is the entry requirement for Recognition of Prior Learning program (RPL)?	There is no general entry requirement. The institute shall assess you, identify your competence gaps and offer you courses to cover the gaps; after which you can take up the final assessment.
7. Is there any age restriction for entry in this course or Recognition of Prior Learning program (RPL)?	There are no age restrictions to enter this course or take up the Recognition of Prior Learning program
8. What is the duration of this course?	The duration of the course work is 950 hrs. (06 to 08 months)

9. What are the class timings?	The classes are normally offered 25 days a month from 08:00am to 01:30pm. These may vary according to the practices of certain institutes.
10. What is equivalence of this certificate with other qualifications?	As per the national vocational qualifications framework, the level-4 certificate is equivalent to Matriculation. The equivalence certificate can be obtained from The Inter Board Committee of Chairmen (IBCC).
11. What is the importance of this certificate in National and International job market?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). These standards are also recognized worldwide as all the standards are coded using international methodology and are accessible to the employers worldwide through NAVTTC website.
12. Which jobs can I get after attaining this certificate? Are there job for this certificate in public sector as well?	You shall be able to take up jobs in the Textile dyeing industries in the functions of supervising different types of dyeing machine operations and also become quality controller to carry out the testing of textile substrate. This is mainly private sector industry and many benefits offered by reputed textile dyeing industry nationally and internationally.
13. What are possible career progressions in industry after attaining this certificate?	You shall be able to progress up to the level of supervisor after attaining sufficient experience, knowledge and skills during the job. Attaining additional relevant qualifications may aid your career advancement to even higher levels.
14. Is this certificate recognized by any competent authority in Pakistan?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). The official certificates shall be awarded by the relevant certificate awarding body.
15. Is on-the-job training mandatory for this certificate? If yes, what is the duration of on-the-job training?	On-the-job training is not a requirement for final / summative assessment of this certificate. However, taking up on-the-job training after or during the course work may add your chances to get a job afterwards.
16. How much salary can I get on job after attaining this certificate?	The minimum wages announced by the Government of Pakistan in 2019 are PKR 17,500. This may vary in subsequent years and different regions of the country. Progressive employers may pay more than the mentioned amount.
17. Are there any alternative certificates which I can take up?	There are some short courses offered by some training institutes on this subject. Some institutes may still be offering conventional certificate courses in the field.
18. What is the teaching language of	The leaching language of this course is Urdu and English.

this course?	
19. Is it possible to switch to other certificate programs during the course?	There are some short courses offered by some training institutes on this subject. Some institutes may still be offering conventional certificate courses in the field.
20. What is the examination / assessment system in this program?	Competency based assessments are organized by training institutes during the course which serve the purpose of assessing the progress and preparedness of each student. Final / summative assessments are organized by the relevant qualification awarding bodies at the end of the certificate program. You shall be required to be declared “Competent” in the summative assessment to attain the certificate.
21. Does this certificate enable me to work as freelancer?	You can start your small business of stitching leather garments, gloves of other products. You may need additional skills on entrepreneurship to support your initiative.

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