Dyeing and Printing

Code: 671

(Job role : Hank Dyer)

NSQF Level 4

Course Coordinator
Dr. Mamta Srivastava

National Institute of Open Schooling
(An Autonomous Institution Under MHRD, Govt of India)
ISO 9001 : 2008 Certified
A-24/25, Sector 62, NOIDA, Uttar Pradesh- 201309

Dyeing and Printing

August 2017

Copies:

Price:

Published by : National Institute of Open Schooling
A-24/25, Sector 62, NOIDA, Uttar Pradesh- 201309

Designed by : Multi Graphics, 8A/101 WEA Karol Bagh, New Delhi -110005

Printed at :

I welcome You

I welcome you to this course on Dyeing and Printing. You all must have seen various dyers dyeing clothes and other articles. You must have wondered what techniques are used to create these intricate patterns. One can use tie and dye, batik and other techniques to make varied intricate designs.

In this course you will learn about how you can introduce the colours on textiles and the essential components of dyeing. You will also learn about various stages of colour application, and how to prepare yarns and fabrics. This course will also help you in creative designing of fabrics using printing and quality in the dyed and printed fabrics. This will help you to identify the poor quality fabrics from the good quality fabrics.

Do not hesitate to write to me in case you face any problem.

Wishing you good luck for your learning and Good luck for your future.

Dr. Mamta Srivastava
Deputy Director, NIOS

Acknowledgement

Advisory Committee	
Prof. C. B. Sharma Chairman National Institute of Open Schooling, NOIDA, Uttar Pradesh	**Dr. Rajesh Kumar** Director (Academic and Vocational Education) National Institute of Open Schooling, NOIDA, Uttar Pradesh

Course Curriculum Committee			
Dr. Swapna Mishra Director Sector Skill Council, Textiles, New Delhi	**Ms. Jyotsna Kapur** Secretary, All India, Women's Educational Fund Association (AIWEFA), New Delhi	**Prof. Promil Pande** Prof. and Dean, School of Fashion and Design, GD Goenka University	**Mr. Vikash Kumar** Assistant Director Weaver Service Centre, New Delhi
Dr. Swarnima Singh Lecturer, Satyam Fashion Institute, NOIDA	**Ms. Navya Agarwal** Entrepreneur, Product and Graphic Designer, Sitapur Uttar Pradesh	**Dr. Bhupinder Kaur** Assistant Professor, Institute of Home Economics, University of Delhi	**Ms. Vandana Jaglan** Assistant Professor, Satyam Fashion Institute, NOIDA

Dr. Amita Walia Associate Professor& HOD, Department of Fabric & Apparel Science, Institute of Home Economics, University of Delhi	**Dr. Simmi Bhagat** Associate Professor, Department of Fabric and Apparel Science Lady Irwin College, University of Delhi

Dr. Mamta Srivastava Dy. Director (Vocational Education) , NIOS	**Dr. Sandhya Kumar** Dy. Director (Academic Department) , NIOS	**Ms. Anitha Nair** Dy. Director (Vocational Education) , NIOS

Dr. Praveen Chauhan Academic Officer, Home Science (Vocational Education), NIOS	**Ms. Asheema Singh** Project Coordinator, AEP, UNFPA, NIOS

Lesson Writer		
Dr. Ritu Mathur Associate Professor	**Ms, Ruchira Agarwal** Assistant Professor	**Ms. Kanika Kakkar** Assistant Professor
Dr. Simmi Bhagat Associate Professor	**Ms. Sheetal Chopra** Assistant Professor	**Ms. Sareekah Agarwaal** Assistant Professor
Dr. Deepali Rastogi Associate Professor	**Ms. Divya Singhal** Assistant Professor	

(**All experts from Department of fabric and Apparel Science, Lady Irwin College, University of Delhi)**

Editors	Course Coordinator
Dr. Simmi Bhagat Associate Professor Department of Fabric and Apparel Science Lady Irwin College, University of Delhi	**Dr. Mamta Srivastava** Deputy Director National Institute of Open Schooling, NOIDA, UP

Graphic Artist
Ms. Vivekta free lance Graphic Designer

Typesetting and Cover Design
Multi Graphics

Contents

1. Colour on Textiles

KEYWORDS

- Synthetic dyes
- Natural dyes
- Pigment
- Mordant
- Affinity

OBJECTIVES

- Describe dyes and pigments
- Name and describe different types of dyes
- Identify Natural dyes according to colour
- Explain the role of mordants in dyeing with natural dyes
- Select dyestuffs according to fibre substrate

1.1 DYES AND PIGMENTS

The first step, in colouring textiles, is to identify and select the colouring material.There are two types of colouring materials used on textiles. These are-

- Dyes
- Pigments

Dyes

Dyes are natural or chemical compounds which are used for colouring the fabrics. Dyes have the following four properties:

1. Impart Colour
2. Soluble in water
3. Absorbed and retained by fibre or become part of the fibre
4. Not get affected during washing and dry cleaning and should give fastness to light, heat and bleaching

Pigments

Pigments are other colourants which do not get absorbed by the fibre but still colour the textiles. Pigments are different from dyes as they -

1. Have no affinity for fibres
2. Are insoluble in water.
3. These can be applied or fixed to fabric by an adhesive, resin or a bonding agent. So it can be applied to all types of textile materials. Fabric coloured with pigment turns stiff due to the presence of adhesive.

Now you know that both dyes and pigments are the main colouring components used on textile materials.

Understanding Fabrics

Fabrics are made of Fibres. On the basis of origin, the textile fibres are classified as natural or man-made fibres.

Natural fibres - are obtained from nature like plants, animals and natural minerals. These are fibrous in nature. For example, cotton, linen, jute.

Man-made fibres are manufactured in laboratory. For example, nylon and polyester.

The chemical composition of each of the fibre influences their physical and chemical properties. They respond in a unique way to heat and chemicals.

Useful Information!!

Dyes are composed of two chemical groups

- Chromophore
- Auxochrome

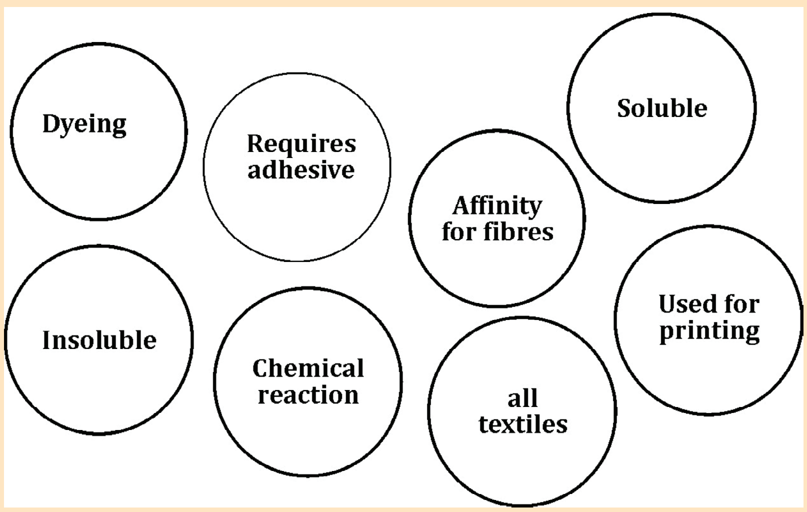
Dyes are able to absorb or reflect colour due to the presence of chromophore. So this part imparts colour.

Brightness of the colour is improved by the auxochrome part of the dye. They also enhance the water solubility of the dye. It also provides the chemical group that attaches itself to the fibre.

Dyes have affinity for the fibre !!

Portfolio Activity 1.1

Paint the pebbles in red colour showing dye characteristics and in blue colour showing pigment characteristics



Know Your Progress 1.1

State whether the following statements are true or false. (write “T” for true and “F“ for false)

1. Dyes attach to the fibre structures with an adhesive.
2. Pigments are insoluble in water.
3. Dyes get absorbed by the fibre
4. Pigments have affinity for the fibre

Fill your score ______ / 8

1.2 CLASSIFICATION OF DYES

In the last section we learnt that dyes have affinity for fabrics and can be applied to textile materials. As there are so many variety of fabrics so are many types of dyes too. Most common classification of the dyestuff is based on the source from which it is made. Accordingly there are two types of dyes-

- **Natural Dyes**
- **Synthetic Dyes**

The **Natural dyes** are obtained from plant, animal and mineral origin. Natural Dyes, like Indigo and Indian madder, have been in use since ancient times.

The **Synthetic dyes** on the other hand were discovered only in mid 19th century. These are man-made and produced in the lab from synthetic resources. Discovery of synthetic dyes declined the use of natural dyes.

Natural Dyes

Natural Dyes are

- Difficult to apply
- Expensive
- Less permanent
- Produced in very less quantities
- Limited in colour range
- Most of them need mordants to stick to the fabric as they do not have affinity for the fabric

Synthetic Dyes

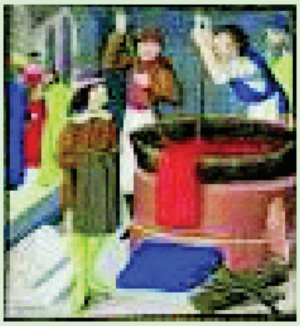
Synthetic dyes are

- Easy to apply
- Fast and bright in colours
- Inexpensive
- Available in wide colour range
- Not limited in quantities
- Attached to the fibre without any mordant as have affinity for the fabric

Useful Facts!

Each class of dye has a very unique chemical composition, structure and a particular way of attaching with the substrate.

Historical facts about Natural Dyes



Natural dyes to color textiles have been known since ancient times. The earliest written record of the use of natural dyes was found in China dated 2600BC. Alexander the Great mentions having found purple robes dating to 541BC in Persia. Bible book of Exodus mentions scarlet colour obtained from Kermes Insect. And by 4th century BC many natural dyes were known like Indigo, Madder, Woad and Brazilwood

Natural dyes are the colouring substances that are obtained from natural sources like vegetable, animal and mineral. Hence on the basis of their source, natural dyes are classified into three categories

- Vegetable dyes
- Animal dyes
- Mineral dyes

Vegetable dyes are obtained by extracting colour from different parts of a plant such as roots, bark, leaves, pods, flowers, fruits, fungi or lichens. Some of the commonly used vegetable dyes that are found in India are mentioned in the following table (1.1).

Table 1.1 : LIST OF VEGETABLE DYES

Name of the dye	Obtained from, Local name	Colour	States producing dye
Indigo	Leaves of the plant, Neel	Blue	Bihar, Assam, Tamil Nadu
Indian Madder/ Alizarine	Roots-Majeeth, Manjith, Manjistha	Shades of Red	Sikkim, Assam
Cutch	Katha	Browns	Nagpur, Mumbai
Tesu	Flowers of Palash	Yellow, grey	Uttar Pradesh, Bihar
Pomegranate	Anar ka chilka	Golden brown, Straw yellow, khaki black	Punjab, Kashmir, Almora
Turmeric	Haldi	Yellow, green, Olive	Andhra Pradesh, Odisha, Tamil Nadu, West Bengal, Assam, Maharashtra

Animal dyes - As the name suggests, these dyes are extracted from the bodies of some insects and invertebrates. Beautiful red, purple and brown colours are achieved from some varieties of insects.

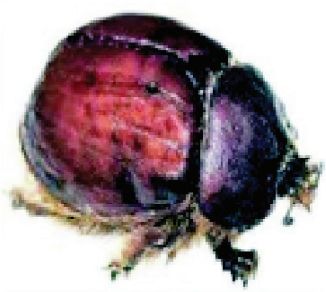


Table 1.2: LIST OF ANIMAL DYES

Animal source	Dye name	Colour obtained
Lac Insect	Lac	Red
Murex snail	Tyrian	Purple
Female red bug	Cochineal	Red

Mineral dyes - Minerals have been used in dyeing since long. They are most commonly used in carpet industry. These dyes are extracted from mineral sources and include Mineral khaki, Prussian blue and Chrome yellow. The commercial usage of mineral dyes have now declined as they may be poisonous.

1.3.1 MORDANTS

You have learnt in first section that colour is obtained on fabric when dye and fibre have affinity. Although some fabrics such as wool and silk can be coloured simply by being dipped in the dye, others such as cotton require a mordant which aids the chemical reaction that takes place between the dye and the fiber so that the dye is absorbed. Majority of the natural dyes and textile fibers, especially cellulosics, do not have much affinity; hence these are subjected to an additional step known as mordanting.

Mordanting involves treating fabrics with a substance called a mordant that helps to fix the dye with the fabric.

Mordants are chemical additives that sometimes help a fibre accept a dye that it might otherwise reject.

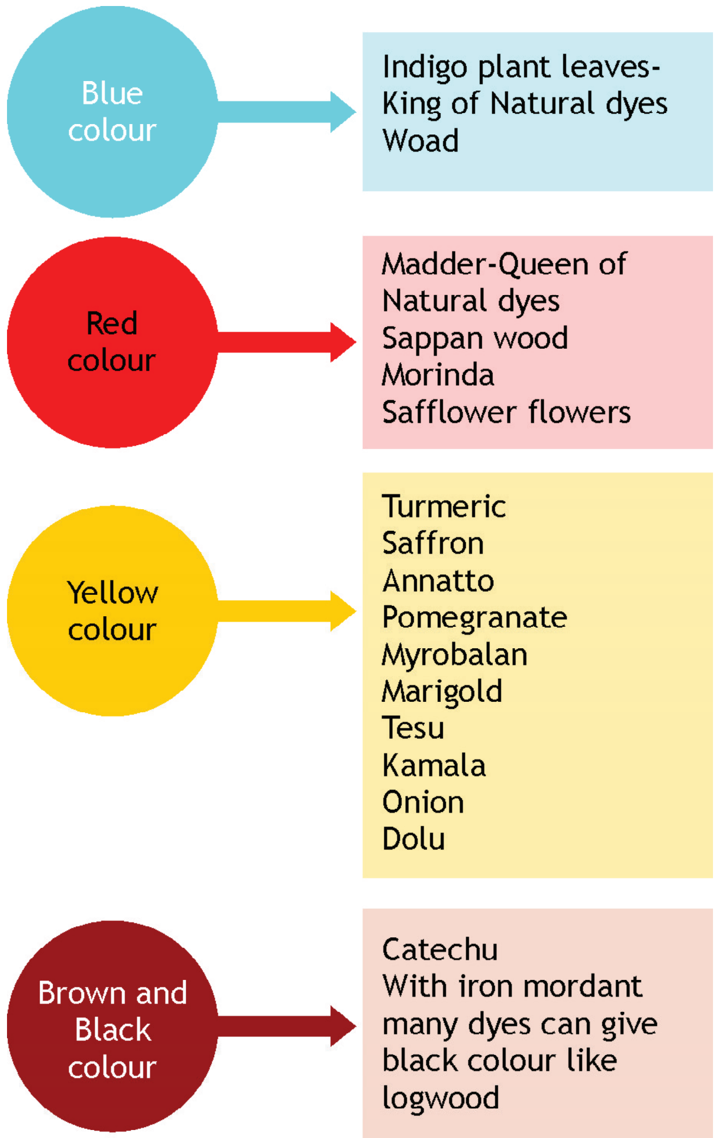
What do mordants do?

- Mordants are the binding agents or substances that have affinity for both textile fibers and dyes
- Acts as a link between the fiber and dyestuff.
- Fixes dye to the fabric and prevents the color from either fading to light or washing out.
- Wide range of colours are possible by combining various mordants and dyes.
- Some mordants darken the colour while some brighten the colour.
- They also improve light and wash fastness properties of the final product.

Following table gives a list of commonly used mordants in dyeing-

Common Name	Chemical Name
Alum	Aluminium potassium sulphate
Chrome	Potassium dichromate
Iron	Iron sulphate
Tin	Tin chloride
Vinegar	Acetic acid

Below are indicated various colours obtained from popular Natural dyes



Portfolio Activity 1.2

Take 3 locally available natural dyestuffs such as haldi, henna, saffron, tea or coffee, onion peels.

3 strips of fabrics- cotton, silk/wool and polyester

Make a dye solution by pouring boiling water on powdered dye (haldi, henna)and stir well.

For tea, coffee and saffron, let them brew in boiling water for few minutes.

Onion peels can be boiled for 10 mins.

Strain the dye solution and dye all the three strips identically keeping same dyeing conditions ie. time and temperature.

After dyeing, observe and compare how well the dye works on different fibres. And what colours are produced by each

You may collect other plant materials and perform similar activity.Take care when collecting samples that you are sure about what you are collecting – many plants can be irritating to your skin or harmful to your health. Care should also be taken not to collect from parks and countryside as certain plants are protected (e.g. lichen)

Know Your Progress 1.2

A. State whether the following statements are true or false. (write "T" for true and "F" for false) -

1. Dyes obtained from minerals are synthetic dyes
2. Tyrian is a purple dye
3. Indian madder is a green dye
4. Cochineal is vegetable dye

B. Write the source of the different Natural dyes against each colour-

1. Blue dye ______________________
2. Yellow dye ______________________
3. Red dye ______________________

Fill your score ______ / 14

1.4 SYNTHETIC DYES

Synthetic Dyes : Almost all the colours that you see on fabrics today are obtained from synthetic dyes. Synthetic dyes are used everywhere in everything such as clothes, paper, food and wood.

They quickly replaced the traditional natural dyes because of many advantages. Can you recall the reasons for the popularity of synthetic dyes over natural dyes?

Table 1.3: LIST OF FABRICS AND THE USED DYE CLASS

Fabric	Dye Class
Cellulosics	Direct, Reactive, Azoic, Vat, Sulphur dyes
Protein	Acid, Reactive, Direct dyes
Nylon	Acid, Reactive, Disperse dyes
Polyester	Disperse dyes

Did You Know?

The first synthetic dye was discovered accidentally by William Henry Perkin in 1856

Types Of Synthetic Dyes

Direct Dyes

These are soluble in water and have direct affinity for all cellulose fibers. These dyes are most economical and easiest to apply. They have moderate to poor fastness to washing. They possess good fastness to light so can be used on fabrics for curtains, furnishings, automotive, linings and also apparel. Direct dyes are used on cotton, wool and silk.

Azoic Dyes

Azoic dyes are actually produced directly onto or within the fibre by a coupling reaction so have good to excellent wash fastness. However, rub fastness is poor so can easily transfer colour on the adjacent white fabric. These dye stuffs are always used in dyeing cellulosic material. It must be remembered that some of the azo dyes are banned world wide as they are carcinogenic in nature.

Vat Dyes

Vat dyes are essentially insoluble in water and incapable of dyeing fibres directly. They require a reducing agent to covert it to soluble form (leuco form), which has affinity for the substrate. This process of converting them into their soluble form is known as vatting. The fabric is taken out from the dye bath and left in the air or immersed in solution of a mild oxidising agent to reproduce the colour. Vat dyes show very good wash fastness and good light fastness. These dyes have great affinity for cotton, linen and rayon. Indigo is the original Vat dye.

Vat Dyes → **Leuco Compound** → **Final Colour**

Reducing Agent **(Vatting)** **Oxidation**

Reactive Dyes

Reactive dyes are most recent dyes and popular in textile dyeing industry. These dyes react directly with the fibre substrate to create a fibre bond making them extremely fast to both light and washing. A wide range of colours are available in Reactive dyes. They are used for dyeing cellulose, protein and polyamide fibres.

Sulphur Dyes

Sulphur dyes, like vat dyes are insoluble in water. These dyes are used to dye cotton with dark colours. Sulphur dyes are not suitable for woollen materials due to high concentration of alkali. The general disadvantage of the Sulphur dyes is that they produce dull shades and lack red colour. The main advantage lays in their cheapness, ease of application and good wash-fastness and light fastness is moderate. Sulphur Black is the largest selling dye by volume.

Acid Dyes

Acid dyes are water-soluble dyes that are applied to fibres such as silk, wool and nylon fibres using neutral to acid dye baths. In general acid dyes have good to very good wash fastness and good light fastness. The colours on silk are less fast as compared to wool. These dyes produce bright colours.

Disperse Dyes

Disperse dyes are water insoluble suitable for dyeing hydrophobic fibres. Carrier or dispersing agent is required for dyeing with disperse dyes. Their main use is to dye polyester. They have moderate to good wash and light fastness.

Basic Dyes

Basic dyes are water soluble dyes. They produce unlimited bright shades on textile materials. Other than acrylic, basic dyes are not very suitable for any other fiber as they are not fast to light, washing or perspiration. They are generally used for giving an after treatment to the fabrics that have already been dyed with acid dyes.

Important!!

Dye is composed of a chemical group and they have affinity for its substrate. That means that there are specific dyes for specific fibres.

Portfolio Activity 1.3

Conduct a survey among people living in areas where dyeing is done. Note their names and area of residence and find out if people show any signs of the following

Skin allergy

Eye irritation

Asthma

Infections

Any other disease

Suggest two ways to reduce incidence of disease in the dyer community.

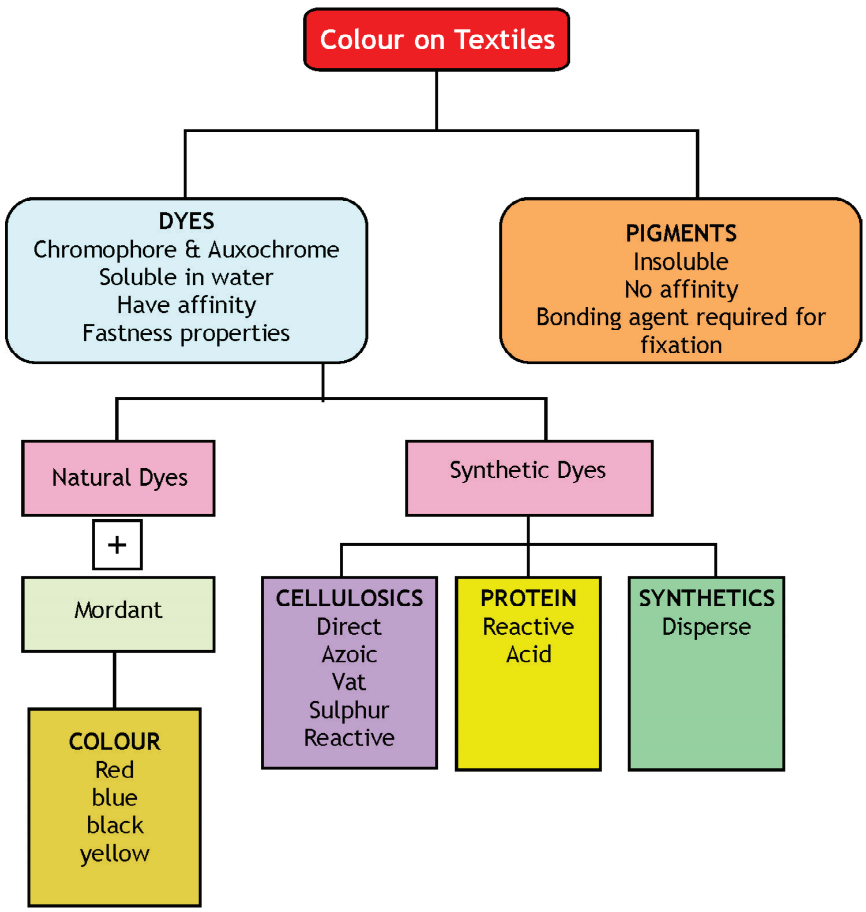
Know Your Progress 1.3

Choose the correct option from the choices given-

1. Direct dyes can be used on
   - a) Polyester
   - b) Nylon
   - c) Cotton
   - d) Acrylic
2. Which of the following dye is directly produced on the fibre by coupling reaction
   - a) Acid dye
   - b) Vat dye
   - c) Sulphur dye
   - d) Azoic dye

Fill your score ______ / 16

1.5 THIS IS WHAT YOU HAVE LEARNT



1.6 LET US PRACTICE

A. Answer the following questions in one word or a phrase

1. List two essential requirements for a substance to qualify as a textile dye.
2. Give two differences between each of the following:
   - A. Dye and pigment
   - B. Direct and acid dyes
   - C. Synthetic and natural dyes
3. Give two reasons for the decline in popularity of Natural dyes.

B. Answer the following questions in 60-100 words

1. How do mordants facilitate dyeing with natural dyes. Explain with an example.
2. Discuss the characteristic features of the following :
   - A. Reactive dyes
   - B. Disperse dyes
   - C. Azoic dyes

1.7 ANSWERS TO KNOW YOUR PROGRESS

Answers to Know Your Progress 1.1

A. 1. F 2. T 3. T 4. F

Answers to Know Your Progress 1.2

A. 1. F 2. T 3. F 4. F

B. 1. Indigo
2. Turmeric, Tesu
3. Indian Madder, lac, cochineal

Know Your Progress 1.3

A. 1. c 2. d

B. Across 1 Alum, 4 Indigo, 5 Direct, 6 Vat, 7 Lac, 9 Reactive

Down 1 Azoic, 2 Pigment, 3 Solubility, 8 Cellulosic

Your Final Score is ________ / 38

Did you know !!!

WATER QUALITY

- Water quality is a key factor in successful dyeing of textiles.
- Broadly speaking water may occur as
  - Soft water
  - Hard water
- Hard water is water that has high mineral content, specially of calcium and magnesium.
- Hard water poses problems while washing of clothes and even bathing as the soaps and detergents do not foam or lather.
- The dissolved minerals can interfere with the dye reaction, preventing a large portion of the dye from bonding to the fiber.
- It is important for a dyer to use soft water for best dyeing results.
- The hardness in water can be either Temporary hardness or Permanent hardness.
- One of the simplest ways of softening water is to boil it for 5-10 minutes. Let it cool and siphon off the water leaving behind any settled salts at the bottom of the vessel.
- If the problem not solved by the above technique, a softening agent maybe used. Use any softening agent available in the market.
- Take care to use only the recommended quantity as excess may interfere with the eying process.

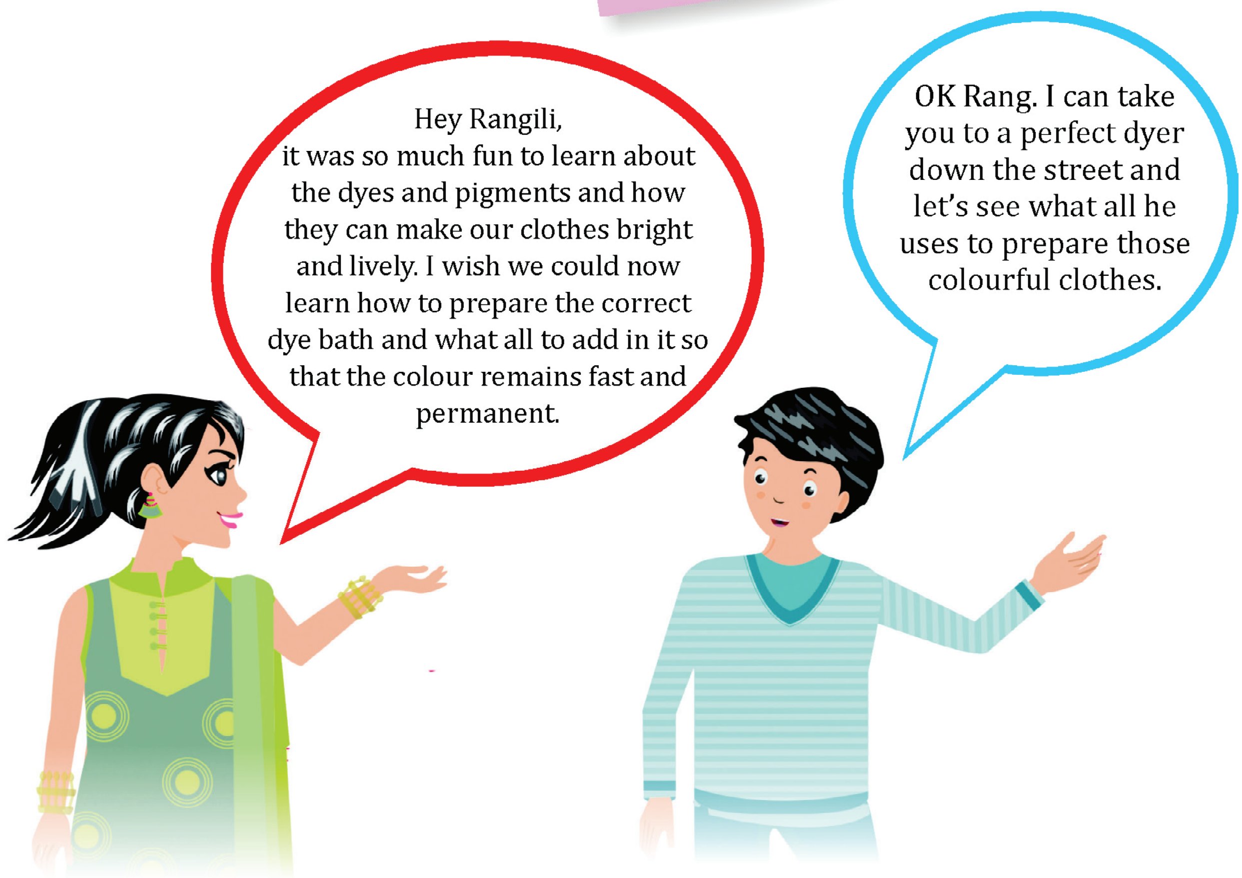
2. Essential Components of Dyeing

KEYWORDS

- Absorption
- Adsorption
- Fixation
- Temperature
- pH
- Auxiliaries

OBJECTIVES

- Describe the theory of dyeing
- List the essential dyeing parameters
- Explain the importance of dyeing parameters to obtain quality product
- List and cite examples of different auxiliaries
- Identify the role of various auxiliaries



2.1 THEORY OF DYEING

In the last chapter, we have seen that dye is taken up by a fibre because of the chemical attraction between them. Let us now see how these attractive forces work. Have you ever got a fabric dyed from a dyer? How much time does he take to dye? You must have waited for the fabric to get dyed. So do you think time is important for dyeing? It is important that the dye bath conditions have to be just perfect so that the attractive forces can work successfully. The chosen dyeing conditions will literally drive the dye towards the fibre. These dyeing conditions will also have to be selected so that your product is evenly coloured in the least possible time.

Remember!!

When you sit down to paint, you always need water to apply the colour on the paper. Similarly, **WATER** is the medium through which dyes are also applied onto the textiles.

Don't make the mistake of treating dyeing to be a process involving simply dipping of the textile in a colour solution. Dyeing is a detailed process and can be broken down into 4 stages:

The four stages of dyeing can be seen to take place as shown below:

Migration — In this process the dye from solution moves towards the surface of the fibre. Movement/ agitation of the dyebath along with increase in temperature helps the dye move faster from the solution towards the fibre.

Adsorption — Distribution of the dye stuff on to the surface of the fibre is known as adsorption. Once near the fibre surface, the dye loosely sits on the fibre surface ready to gradually move inside.

Absorption/ Diffusion — After adsorption on the surface, absorption of the dye takes place and the dye moves from the surface towards the centre of the fibre. The rate at which this happens is influenced by the temperature. Higher the temperature, greater is the degree and rate of diffusion.

Fixation — This process is the attachment of dye to the fibre molecules by various bonds or other forces so that the dye is less likely to come out.

There are various types of bond formations that can take place between dye and fibre. Stronger bonds lead to better fastness properties and dye does not come out easily during washing etc. Weaker bond formations result in moderate to poor fastness properties.

Facts!!!

Strong Bonds- Covalent bonds, Hydrogen bonds, Ionic bonds

Weak Bonds- Van der Wall forces

Know Your Progress 2.1

1. **State whether the following statements are true or false. (write "T" for true and "F " for false)**
   1. Migration is the process of distribution of the dyestuff on the surface of the fibre
   2. The process of attachment of dye molecules to the fibre is known as adsorption
   3. Weak bonds between dye and fibre result in poor fastness properties
   4. Higher the temperature, greater is the rate of diffusion of dye
2. **Fill in the blanks with suitable answers**
   1. Tendency of a dye to move from a solution towards the fibres in the dye solution is due to __________.
   2. The third stage of dyeing is known as ______________.

Fill your score ________ / 12

2.2 IMPORTANT PARAMETERS OF DYEING

Let's make a note of the factors that you must always be careful of, for successfully colouring textiles. These factors or conditions are also known as the **dyeing parameters**. A skillful dyer should be able to produce the same shade every time that it is required. It is possible to achieve this by proper control of the following conditions during dyeing.

1. Temperature
2. pH
3. Time
4. Material to liquor ratio

Now, let's discuss these in a little more detail to understand how they can influence the quality of the final dyed product.

1. Temperature

The temperature at which the dyeing is done plays a very important role in producing evenly dyed products. You should know that for faster dyeing, it should be carried out at a higher temperature. **But be careful!! Choose a temperature that doesn't spoil the fabric.** Higher temperature also resultin more even dyeing and the dye also goes deeper inside the fibres for colours that will last longer.

Don't make a mistake of jumping at once to a high temperature. Always remember to begin the dyeing process at a lower temperature and slowly raise it over a period of time. The exact temperature of dyeing and the time schedule varies from dye to dye and will be shared with you in chapter 5.

> Proper temperature control during the dyeing process is absolutely essential.

2. pH

pH Range

Acidic- 1-6

Neutral- 7

Alkali- 8-14

Many of you may not have heard of this term. Let's try to understand it in very simple terms. pH is a number that indicates how acidic or basic a solution is. Every chemical reaction works best at a certain pH. The pH values range between 1-14. Acidic range of pH varies between 1-6 while pH of 8-14 is termed as alkaline range. pH of 7 is known as neutral (it is also the pH of water without any additives).

Cellulosic fibres such as cotton, linen, rayon and jute can get dissolved by strong acids, therefore while dyeing these fibres, be careful to use either neutral or slightly alkaline pH. Similarly, for all protein fibres such as wool and silk, strong alkaline chemicals have to be avoided, therefore select a pH in the acidic range. Mild acids such as citric acid (found in lemons) or acetic acid (commonly also known as vinegar) can thus be used during the dyeing process.

Each dye is able to colour the textile in the best possible manner without damaging it only if you are careful in maintaining the required pH.

> As with temperature, proper pH requirements have to be maintained during dyeing.

3. Time

Recall what we learnt earlier! Dyeing is a 4 step process and it will only be complete if you reach the 4th stage of fixation. To reach there you must give it enough time. To get the colour you want, be patient and give enough time to your dyeing process.

If the time is kept too short, the dye may have just got adsorbed on the surface and will come out easily during the washing process. If it is too long, you're just wasting time.

> Optimum dyeing time is recommended so that it allows the dye to enter deeply into the fibre structure.

4. Material to Liquor Ratio (MLR)

MLR stands for "material to liquor ratio". This refers to the relationship between the fibre to be dyed and the total volume of water to be taken for dyeing. An M:L ratio of 1:20 means that for 1 kg of fabric, 20 litres of water is required. If the weight of the fabric is 10 kgs, the amount of water required will be 200 litres.

Just as the right amount of water is important in laundry, the right amount of water is important for a good dyeing. If the water taken is very less, the colour on the fabric will be patchy and uneven as the material will not be immersed properly in the solution. When very large quantity of water is taken the colour gets much diluted and so the desired colour is not achieved. Also, it means wastage of precious water and then finally the problem of throwing away so much dirty water.

> A proper MLR has to be maintained for getting perfect dyeing results

Portfolio Activity 2.1

Take 3 samples of cotton fabrics in the following sizes:

6 inches by 6 inches

10 inches by 10 inches

20 inches by 20 inches

Take the weight of the 3 samples and calculate the amount of water required for each of them according to MLR 1:30. Record your observations in the table below:

SAMPLE SIZE	WEIGHT IN GRAMS	WATER REQUIRED (MLR 1:30)
6 X 6 inches		
10 X10 inches		
20 X20 inches		

Portfolio Activity 2.2

Take 2 samples of white cotton fabric of size 6 inches X 6 inches. In 2 vessels take water according to 1:30 MLR. Add half teaspoon of dye in both vessels (approx 5gms).

Add the cotton samples to each of the vessels. Heat one vessel and take temperature to boil in half an hour. The other vessel is maintained at room temperature.

Which sample takes up more colour after half an hour. Can you give the reason why one sample is darker than the other?

Know Your Progress 2.2

1. **State whether the following statements are true or false. (Write "T" for true and "F" for false)**
    1. Higher dyeing temperature ensures level and even dyeing and better penetration of the dye into the fibres.
    2. The acidic pH range is 8-14 and alkaline is from 1-6
    3. The M. L ratio gives the relationship between the time and temperature of dyeing.

Fill your score ________ / 6

2.3 DYEING AUXILIARIES

Auxiliaries are the chemical substances that are added in small quantities to the dye bath to help speed up the process and to carry out the dyeing in a more efficient manner. These auxiliaries may be used for both dyeing and printing of textiles.

Commonly used auxiliaries for dyeing processes are as follows:

- Wetting agent
- Levelling agent
- Electrolyte
- Alkali
- Acid
- Reducing agent
- Oxidising agent

Let us now understand the function of each of these in a little more detail.

- ## Wetting agent

Have you ever noticed a drop of water on a leaf of a lotus flower (*kamal ka phool*). It looks like a round pearl and can drip off without wetting it. We definitely don't want that to happen when the water containing the dye comes in contact with the fabric. If this happens the fabric will not soak up the coloured water and no colour will be transferred onto the fabric.

A wetting agent is a chemical substance which normally helps in easy penetration of the dye and the chemicals into the fibre.

To avoid this to happen, a wetting agent is required while dyeing. Commonly used wetting agents are Lissapol, TRO (Turkey Red Oil) etc.

- ## Levelling agent

They are also called retarding agents or retarders. These are substances which help to produce even dyeing or level dyeing. It ensures that the colour is uniform all over without any patchiness.

Levelling agent tends to slow down the dye uptake of the fibres helping to produce more uniform colour in the textile fibre.

- ## Electrolyte

You might have seen the dyers put common salt (*namak)* during the dyeing process. Salt is an electrolyte and it plays the very important role of promotingthe dyeing process.

Electrolyte helps to drive the dye towards and into the fibre during the dyeing process thereby leading to maximum uptake of dye onto the fibre.

- ## Alkali

Alkali is very important when dyeing cotton and other cellulosic fibres with Reactive dyes. It is required for the fixation of the dye. Without the alkali, the dye will not get fixed to the fibre and may come out easily during the washing process.

An alkali is required to maintain the pH of the dye bath in the alkaline range which is between 8-14.

Washing soda or soda ash (sodium carbonate) is a common alkaline agent used for this purpose. Other alkalis are baking soda (sodium bicarbonate).

Acid

Stronger acid lowers the pH to 1-3 while mild acids keep it between 4-6. Acid is normally required when dyeing silk, wool and nylon with acid dyes.

An acid is required to maintain the pH of the dye bath in the acidic range (1-6).

Vinegar (*sirka*) is a commonly used acid for dyeing. Acidic conditions can also be produced by using lemons which contain citric acid.

Reducing agents

Some dyes such as Vat and Sulphur are not available in the insoluble form. Once the dyeing is complete, it can be converted to the insoluble form by oxidation. This imparts the dye very good fastness properties since the insoluble form does not come out easily during subsequent washing. Reducing agents are also commonly used for bleaching of protein fibres since chlorine containing bleaches cannot be applied on them.

A reducing agent is normally required which converts the dye to the soluble form.

Commonly used reducing agent for dyeing is sodium hydrosulphite (commonly referred to as “hydros”) and sodium sulphide.

Oxidising agent

Oxidizing agents are also commonly used for both dyeing and bleaching. Dyes such as Vat and Sulphur have to be reduced to bring them into a soluble form. The purpose of oxidation is to convert the water-soluble vat or Sulphur dye, back into the insoluble pigment form. Therefore anoxidizing agent is required after the dyeing is complete to convert it back to the insoluble form. This is a very essential step to ensure good fastness properties of the dyed textiles. Oxidation can also happen by exposure of dyed textiles to air by an “air oxidation” process for 20-30 minutes. The oxygen in air helps to convert the leuco (soluble) form of dye to its insoluble form.

Common oxidizing agents used for bleaching are sodium hypochlorite (liquid bleach), hydrogen peroxide, sodium perborate etc.

Did you know that sunlight is also a natural oxidizing agent?

This is also the reason that coloured clothes fade/lighten when exposed to strong sunlight.

Portfolio Activity 2.3

Plan a visit to the local dyer and observe the process of dyeing he follows in terms of the following. Record your observations in the table given below.

S. NO	PROCESS OF DYEING	OBSERVATIONS
1	Amount of dye taken	
2	Amount of water used	
3	Auxiliaries used	
4	Temperature control	
5	Time of dyeing	

1. Do you think the amount of water was appropriate for the dyeing process?
2. Suggest if the temperature was regulated properly.
3. Suggest improvements in the execution of the process observed.

Know Your Progress 2.3

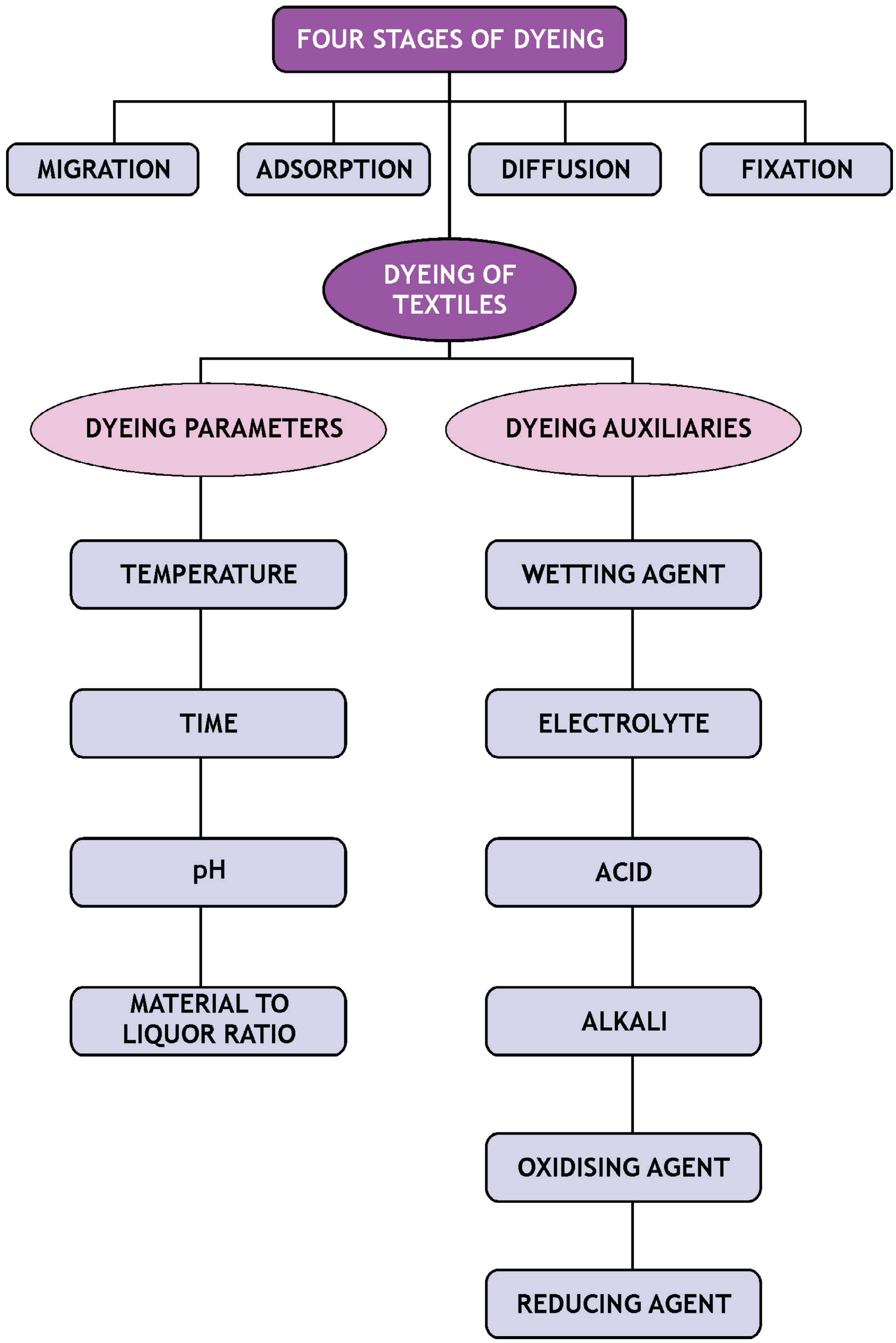
1. Match the following dyeing auxiliaries in column A with their characteristics in column B:

Column A	Column B
a. Electrolyte	i. pH range 8-14
b. Oxidising Agent	ii. Maximum dye uptake
c. Alkali	iii. pH range 1-6
d. Acid	iv. Sodium Hypochlorite
e. Reducing Agent	v. Sodium Hydrosulphite

Fill your score _______ / 10

2.4 THIS IS WHAT YOU HAVE LEARNT

The following flowchart explains the four stages of dyeing and the essential parameters and auxiliaries required to obtain a quality dyed product with even and uniform dyeing



2.5 LET US PRACTICE

1. List and briefly explain (in 1-2 lines) the four stages of dyeing.
2. Discuss how proper temperature and material to liquor ratio can influence the quality of the final dyed product.
3. Cite one example each of the following auxiliaries
   a. Acid
   b. Alkali
   c. Oxidizing agent
   d. Reducing agent
4. Explain the role of the following in obtaining a level dyeing
   a. Electrolyte
   b. Wetting agent

2.6 ANSWERS TO KNOW YOUR PROGRESS

Answers to Know Your Progress 2.1

Ques 1: 1. F; 2. F; 3. T; 4. T

Ques 2: 1. Migration 2. Diffusion

Answers to Know Your Progress 2.2

Ques 1: 1. T; 2. F; 3. F

Answers to Know Your Progress 2.3

Ques 1: a. (ii); b. (iv);
c. (i); d. (iii)
e. (v)

Fill your score ________ / 32

Did you know !!!

DABU

Dabu is a mud-resist hand-block printing practiced in Rajasthan of India. Dabu printing is very labor intensive and involves several stages of printing and dyeing; the end result is therefore very unique and beautiful.

History: The art of hand block printing is an ancient one, which is said to have originated in China. Over the years it traveled to India, with the state of Rajasthan becoming the most prolific producer of hand block printed fabrics. Dabu block printing is a special variation, the origins of which can be traced to about 675 A.D.

Colors and dyes: Traditional dabu prints are made with natural dyes like kashish (grey-brown) and indigo (blue), as well as yellows and reds derived from fruits like pomegranate. Today a lot more color options are available to artisans since they are no longer restricted to vegetable dyes and can use synthetic dyes as well. Fabrics can also be dyed more than once, creating the double dabu and triple dabu effect with a richer, more colorful look.

Motifs and designs: The typical motifs used are nature-inspired ones of peacocks, mangoes, leaves, cornstalks (called boota), sunflower (surajmukhi) and animal figures. **Geometric** shapes, dots and wavy lines may also be used.

Production centres: Village of Akola, in the Chittorgarh district of Rajasthan, is the main centre of production for Dabu printed fabrics.

3. Stages of Colour Application on Textiles

KEYWORDS

- Stock dyeing
- Beam dyeing
- Package dyeing
- Skein dyeing
- Hank dyeing

OBJECTIVES

- Describe the various stages of dyeing
- State advantages and disadvantages of different stages of dyeing
- Indicate design possibilities at different stages of dyeing
- Select most appropriate dyeing stage according to design

Let us now discuss the process of colour application at different stages of textiles

3.1 STAGES OF COLOUR APPLICATION

The colour can be applied on the textiles at any stage of their development from fibre to fabric or certain garments.

Various stages of colour application are-

Each stage of colour application has its significance. Special effects can be achieved because of the dyeing at a particular stage

- Fibre
- Yarn
- Fabric
- Final product stage

Now, let us understand the application of dye at each stage in details.

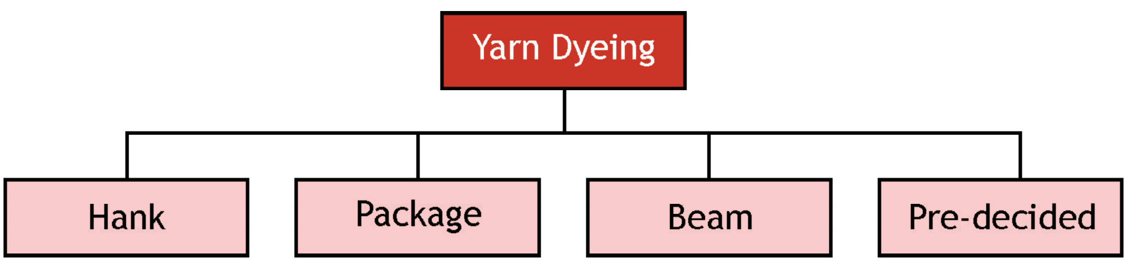
a) Fibre stage

Dyeing at fibre stage results in uniform colouration and excellent fastness as the dye penetrates through individual fibre. It is done at a commercial level in large closed tanks that are called kiers. The fibres are packed in these tanks and dye liquor is pushed through them causing deep penetration of colour.

Stock dyeing refers to dyeing a staple fibre before it is spun.

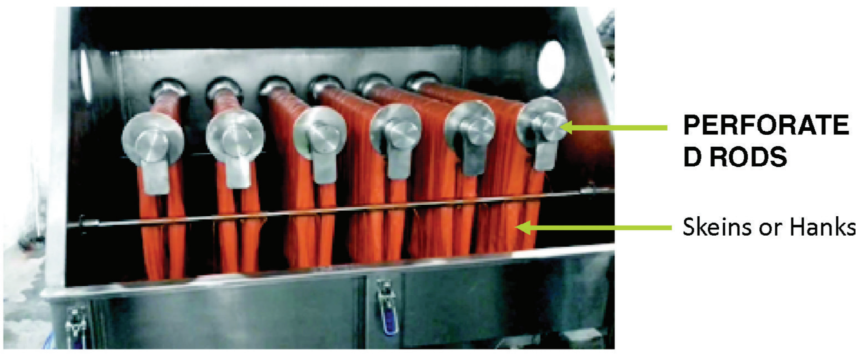
b) Yarn Stage

When dyeing is done after the fibre has been spun into yarn, it is described as yarn dyeing. Dyeing at the yarn stage is useful for creating various types of patterns on the fabric made out of this yarn. It can be done in the following four ways-

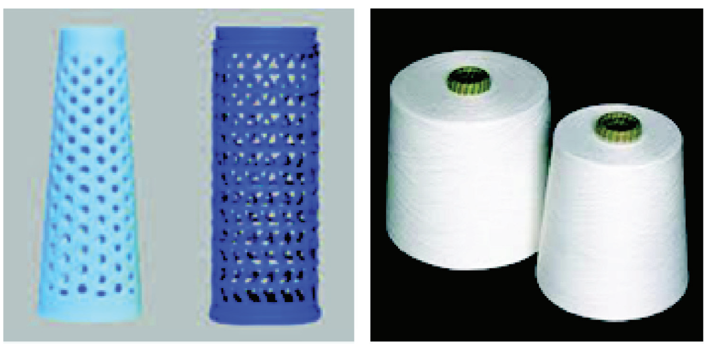


1. **Skein/ Hank dyeing –** This is the most popular dyeing method at a small scale/ cottage level. A small amount of yarn can be dyed. It can be done at home in small 'patila' or bucket as per the dyeing recipe.

Commercially, in this process, the yarns are prepared in the form of skeins (a length of yarn wound in a loose coil) and hung on perforated rods which are placed in the dye vessel. The dye liquor is pumped/pushed through the skeins.

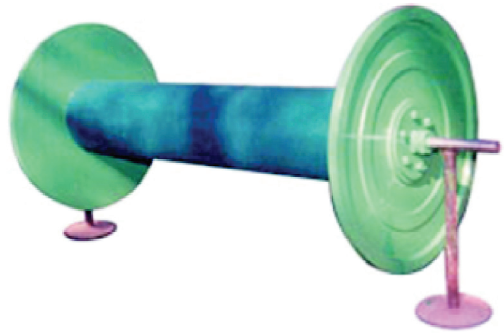


2. **Package dyeing -** Winding up of yarns on a small perforated spool or tube is called a package. This dyeing is done at an industrial level.



Perforated spool and Yarn

The packages of yarn are stacked into the dyeing machine in which the dye liquor is pushed from the centre to outside, and then from outside to the centre of it. If done at small scale, package dyeing will require assistance from a specialist.



3. **Beam dyeing –** You all are aware of warp beam of loom. Commercially, warp yarn can be dyed on beam also directly. These beams are placed in a dye vessel in special beam dyeing machines.

4. **Dyeing of yarn according to pre-decided design –** For the construction of some of the traditional Indian textiles like Ikats (Pochampali & Patola), the yarns for warp and weft are tied and then dyed to create intricate designs. For patterned fabrics like stripes, plaids, checks, muted colour arrangements and iridescent effects, the yarns are dyed in different colours and woven or knitted into a fabric.

c) Fabric Dyeing

This type of dyeing, we commonly see in local dyeing shops in the markets. It is used for dyeing solid coloured fabrics specially for matching garment pieces. The local dyers dye fabric in 'patilas' using correct method to give a good quality product. Generally, single piece is dyed by this method. This is a process of dyeing fabric to get solid colours.

Did You Know!!

Dyeing of goods has been done in the world since mid 14th century. In the image below note the ladder that one dyer climbs to colour the fabric in large barrels.

Source: http://www.elizabethancostume.net/dyes/dyepics/english14thcdyers.html

Commercially, fabrics can be dyed in open width in a machine called jigger (jig dyeing) and in the rope form in a machine called winch. Most of the plain coloured fabric that we get in the market is dyed at the fabric stage. Since, the quantities of the fabric to be dyed is very large so large industrial machines are used.

Have you ever gone to a dyer to get a garment dyed?
What kind of garments do you get dyed?

d) Product Dyeing

This is the last stage of dyeing in which a finished product is dyed.

This stage offers the possibility of producing unique effect. It is suitable when all components (including threads) need to be dyed the same shade; for example, hosiery products like socks are knitted, stitched with thread that dyes to the same shade, and then dyed. This process is suitable for quick response orders like T-shirts, sweaters, and other casual clothing that demands for certain popular colours .Commercially, it is usually done in a large machine called 'Rotary drum machine.' At small scale, the finished product can also be dyed separately in large vessels containing dye bath.

Portfolio Activity 3.1

List and search images of the dyeing machines used for the following:

a. Fibre dyeing

b. Yarn dyeing

c. Fabric dyeing

d. Garment dyeing

Know Your Progress 3.1

A. State whether the following statements are true or false. (write "T" for true and "F " for false) –

1. The yarns for warp and weft are tied and dyed from lighter to brighter shades.
2. Jigger can be used for dyeing of fibers.
3. At a small scale, finished product can be dyed in large vessels containing dye bath.
4. In skein dyeing the yarn is wound on a small perforated package.
5. For warp yarn dyeing, warp yarns are wound on a beam (warp beam) and are placed in a dye vessel.

B. Fill in the blanks with suitable answers -

1. Yarn is wound on a small perforated __________ called a package.
2. Dyeing at fibre stage involves the large closed tanks called _________.

Fill your score _____ /14

Why is dyeing done at different stages? Let us study in the following section.

3.2 ADVANTAGES AND DISADVANTAGES OF VARIOUS STAGES

For understanding this, let us look at the advantages and disadvantages of each stage of dyeing

S. No.	Dyeing Stage	Advantages	Disadvantages
1.	Fibre	♦ Deep, uniform and fast colours	♦ Time consuming and expensive process
2.	Yarn	♦ less labour intensive than fibre dyeing ♦ It allows the use of variously coloured yarns in a single fabric resulting in fabrics like checks, stripes, plaids, muted colour arrangements, etc.	♦ More time consuming and expensive than fabric and product dyeing
3.	Fabric	♦ Very economical ♦ It is the most common method of dyeing solid coloured fabrics specially 'fad colours'. ♦ The process is suitable for "quick response" orders	♦ Dye penetration may not be good in thicker fabrics as it does not allow a thorough penetration of dye into the fabric,
4.	Garment	♦ Possibility of producing unique effects	♦ Poor appearance ♦ More possibility of colour bleeding

Portfolio Activity 3.2

a. Visit a local market and collect four samples each of cotton fabric dyed at different stages of textiles which include fibre, yarn, fabric and product..Identify the design /pattern and the price for each of them.

S. No.	Dye stage	Design / Pattern	Price
1.	Fibre		
2.	Yarn		
3.	Fabric		
4.	Product		

Know Your Progress 3.2

A. State whether the following statements are true or false. (write "T" for true and "F" for false) –

1. Dyeing at fibre stage leads to deep, uniform and fast colours.
2. Fibre dyeing is the most commonly used method for dyeing solid coloured fabrics specially 'fad colours'
3. Product dyeing leads to unique effect possibility
4. Fabric stage dyeing is not suitable for quick response orders

B. Fill in the blanks with suitable answers -

1. At ______dyeing stage the dye penetration may not be good in thicker fabrics
2. At yarn stage fabrics like ______ & _______ can be made

Fill your score ______ /12

3.3 DESIGN POSSIBILITIES AT DIFFERENT STAGES OF DYEING

Various designs can be achieved by dyeing at different stages development of textiles.

Fibre Stage

Fibre dyed in different colours is used to create interesting yarns after spinning. These yarns further create patterned fabric. One of the most commonly used example is Tweed. Tweeds are fabrics with colour effects in the yarn which may be obtained by mixing dyed wool fibre before it is spun into a yarn. They are mostly used for upholstery, jackets and blazers.

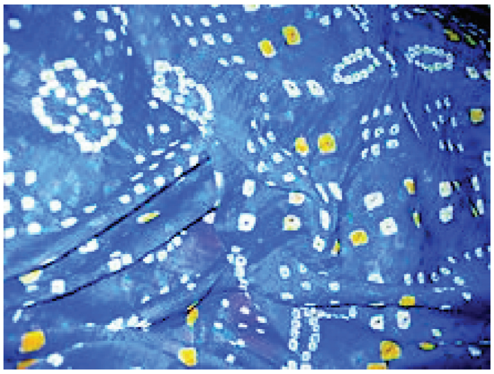
Yarn Stage

Yarn dyeing is the common site in many traditional textile producing centres. The dyed yarns can be used to produce fabric with various patterns like stripes, checks, and plaids. Some of the traditional textiles are produced by yarn dyeing.. These textile crafts are Pochampalli of Andhra Pradesh, Patola and gharchola of Gujarat and Ikats of Orissa. Here, tie-dye technique is used to produce elaborate patterns by weaving.

IKAT CHECKS STRIPES

Fabric Dyeing

Very beautiful patterns are created at fabric dyeing stage. These include famous Lehriya and Bandhej patterns of Rajasthan. The technique used to create these patterns is called tie n dye.



Finished Product

At this stage, unique effects of symmetrical or asymmetrical ombre effects can be created. Tie and dye may be used on T shirts to create interesting effects.

Portfolio Activity 3.3

Visit a local market and collect any 5 patterned samples. With reference to the pattern, identify the stage at which the fabric is dyed.

Know Your Progress 3.3

A. State whether the following statements are true or false. (write "T" for true and "F" for false) –

1. Pochampallis, Patolas and gharcholas are the traditional textiles which are made by dyeing at fibre stage
2. Product dyeing helps create ombre effects
3. Fabrics with "heather" look are fibre dyed

B. Fill in the blanks with suitable answers -

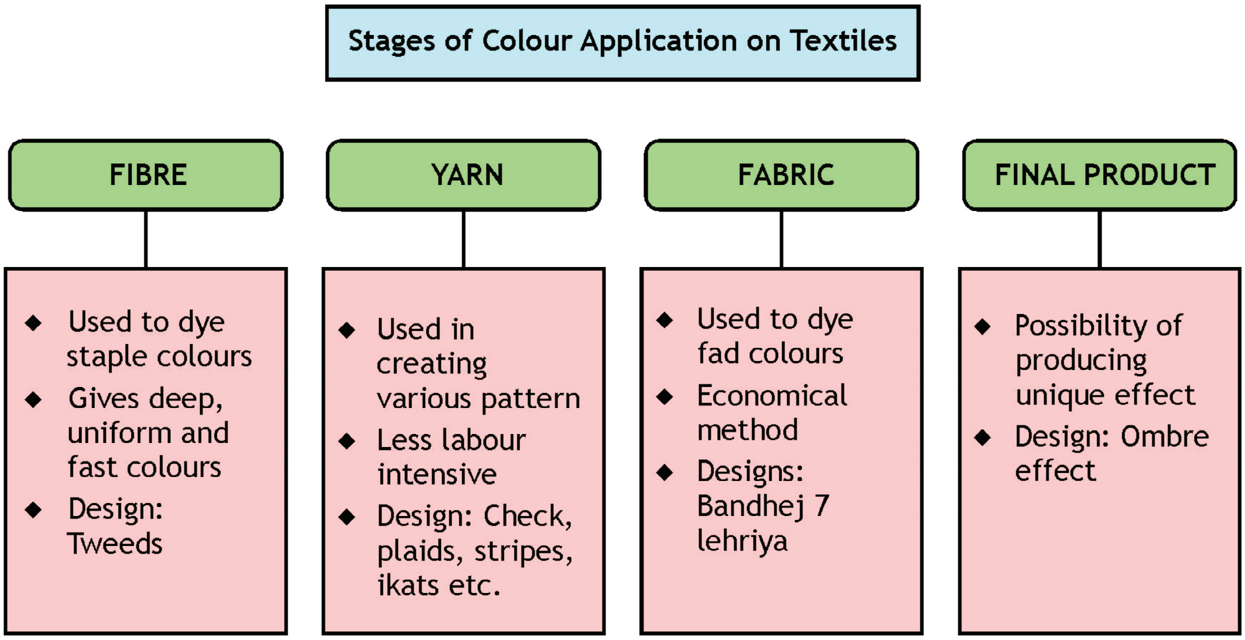
1. Dyeing at fabric stage can lead to designs like _________ & _________.
2. Tweeds are _______dyed fabrics.

Fill your score ______ /10

3.4 THIS IS WHAT YOU HAVE LEARNT

The application of dye can be done at various stages of development of textile, but at fibre stage the colour penetration is the deepest with best fastness properties as compared to the rest of the stages. Each stage of dyeing offers different design variations. The dyeing stage can be chosen as per the requirement of the design.

Some of the key points are highlighted in the flow chart below:



3.5 LET US PRACTICE

1. Give reason for good colour fastness achieved at fibre dyeing stage.
2. Explain various design possibilities with reference to various stages of dyeing.
3. Discuss the advantages and disadvantages of the following
   a) Fibre dyeing
   b) Yarn dyeing
   c) Fabric dyeing
   d) Final product dyeing
4. At what stage is bandhini pattern created. Describe the technique briefly.
5. Explain the following terms - Ikat, Tweed, Ombre

Answers to Know Your Progress 3.1

A. 1. T
2. F
3. T
4. T
5. T

Answers to Know Your Progress 3.2

A. 1. T
2. F
3. T
4. F

B. 1. Fabric
2. Checks & Stripes

Answers to Know Your Progress 3.3

A. 1. F
2. T
3. T

B. 1. Bandhej & Lehriya
2. Fibre

Fill your score ______ / 36

4. Preparing Yarns/Fabrics for Dyeing and Printing

KEYWORDS

- Grey fabric
- Desizing
- Degumming
- Bleaching
- Scouring
- Mercerisation

OBJECTIVES

- State the importance of preparatory processes for dyeing and printing.
- Explain the preparatory processes for cotton and silk.
- Understand the need for work material disposal in the approved manner.
- Ensure personal safety.


Hello Rang, Rangili! How are you? Good to see you again.
Namaste Uncle! We have another query from you. Do we need to prepare the fabrics before dyeing and printing them?


You have come just in time. Let me show you a cotton fabric that I have got from the weaver.
Look Rangili! There is magic in this fabric. It is floating in water. It is not soaking water.
Rang, Rangili, will you soak this fabric in this tub of water?

4.1 IMPORTANCE OF PREPARATORY PROCESSES FOR DYEING AND PRINTING

Do you know why the cotton fabric given by Dyer Uncle was floating on water?

This is because this fabric cannot absorb water.

This fabric which is obtained after weaving is known as GREY fabric. Now, do not get confused with the colour 'Grey'. Grey fabric here means raw unprocessed fabric; just like your raw vegetables!! This grey fabric contains various kinds of impurities which make the fabric stiff, non-absorbent and greyish yellow in colour. In order to make the fabric suitable for dyeing and printing and final use, it is essential to remove these impurities present in grey fabric. The processes involved in the removal of these impurities are known as preparatory processes or fabric pre-treatment.

Just like you cook your raw vegetables to make tasty food, similarly you need to dye/print the grey fabric to obtain beautiful fabrics!

AND

Just like you have to wash and clean your raw vegetables before cooking them, similarly you have to clean your grey yarns and fabrics before dyeing and printing them.

Preparatory processes are the processes given to clean and prepare the yarns and fabrics for dyeing and printing.

The nature of the impurities present on grey fabric depends on the nature of fibre from which the fabric has been made. For example, the impurities present on cotton would be different from those present on silk.

Do You Remember?

Dyeing can be carried out at the fibre, yarn or fabric stage (Chapter 3).

Depending on which stage you are carrying out dyeing, you will have to clean and prepare the fibres, yarns or fabrics.

Purpose of Preparatory Processes

- To remove the impurities from yarns and fabrics.
- To impart water absorbency to yarns and fabrics.
- To improve the appearance of fabrics.
- To make yarns and fabrics suitable for dyeing and printing.

Know Your Progress 4.1

Q1. Fill in the blanks:

i. The fabric obtained from the loom immediately after weaving is called ___________.

ii. The processes involved to prepare the fabrics/yarns for dyeing and printing are called _________________.

iii. The impurities present on a fabric will depend on the nature of ________.

Q2. List three functions of Preparatory Processes

i. ________________

ii. ________________

iii. ________________

Fill your score _____ / 12

4.2 PREPARATORY PROCESSES FOR COTTON FABRIC

Impurities on Cotton Fabric

- Wax/greasy material
- Starch/size
- Natural colouring pigments
- Oil stains
- Dust

Now that you understand the importance of preparing fabrics before dyeing and printing, let us learn about the processes used for preparing cotton. You all may recall that cotton fibres are obtained from cotton plant. Cotton fibres have been given a layer of wax by nature for their protection. This wax or greasy material forms a very fine and uniform layer on cotton fibres and thus does not allow the water to penetrate the fibres. Another significant impurity present on cotton fabric is size or starch which is applied on warp yarns at the time of weaving. Apart from these, there may be some dust, oil stains and natural pigment on the fibres.

The various preparatory processes for cotton are as follows:

Desizing	Scouring	Bleaching	Mercerisation
Removes starch/ size and dust	Removes wax and oil stains	Removes colouring matter	Improves dye uptake, strength and lustre of cotton

Let us now learn more about each of the above preparatory processes:

Desizing

Desizing is the process of removing size/ starch from the woven fabrics after they come out of the loom and before they go for further processing. You can easily desize your fabric by using any one of the following simple methods:

1. Rot steeping
2. Acid desizing

> Size is the coating of starch or any other resin applied on the warp yarns before weaving.
>
> Desizing is the process of removing it!
>
> Knitted cotton fabrics do not have size/starch on them, therefore they do not require desizing treatment.

1. Rot Steeping

In this process, the grey fabric is soaked in water for 16-24 hours at room temperature. You can soak the fabric in a cemented pit or a cemented tank or even in a stainless steel vessel (Patila). Make sure to keep the fabric soaked in water by putting some weights so that it does not float above the water level. Otherwise the floated fabric layers will be exposed to air and will get dried due to which the starch will not be removed properly from the exposed areas. After steeping for the required time wash the fabric thoroughly with hot and cold water to remove the starch.

2. Acid desizing

Well! Rot Steeping can remove the starch but it takes a lot of time. If you want to remove the size in shorter time period you can add small quantity of acid to water. The starch breaks down faster in the presence of acid, therefore less time is needed.

You can use sulphuric acid or hydrochloric acid in very small quantity, i.e., 5 grams in one litre of water. Use enough water to soak the fabric properly. You can either leave the fabric soaked in the acid solution for 3 to 4 hours at room temperature or you can squeeze out extra solution and wrap the fabric in a polythene sheet and leave it for 3 to 4 hours.

Let us go through the acid desizising steps:

1. Soak the fabric in sulphuric acid or hydrochloric acid solution (concentration 5g/l).
2. Keep the fabric soaked for 3-4 hours at room temperature.
3. Wash with cold water, then neutralise with sodium carbonate solution (washing soda) (2 g/l) followed by hot and then cold water wash.
4. Dry the fabric.

Be Careful!!!

1. Do not allow the fabric to dry after soaking with acid solution. It will get damaged faster at the dried areas.
2. Make sure that during washing operation acid is completely removed and the fabric shows neutral pH (pH 7).
3. Be careful to use the correct quantity of acid. You are aware that acid can cause excessive damage to cotton. Therefore, precautions in terms of concentration of acid, time of treatment and temperature must be taken to avoid loss of strength of cotton fabric.

Safe Disposal of Acids!!!

You not only have to protect yourself, but also your environment from the damage that can be caused by acids.

It is very important to dispose the acid safely. And it is SIMPLE!!

All you have to do is to add a base/alkali such as, caustic soda (Sodium Hydroxide) solution very slowly to the acid solution and bring its pH value close to neutral (6.5-7.5).

Now you can disposeoff the solution in the drain safely!

Be careful while handling Acids!!

- Keep your eyes and face away and protected while handling acid.
- Always usePersonal Protection Equipment (labcoat, goggles and acid proof gloves) while working with acids.
- Always add acid to water and never add water to acid.
- Flush your eyes and other body parts with plenty of water if they come in contact with acid.
- Keep an acid spill kit in your vicinity.
- Keep your work areas well ventilated.
- STORE ACIDS OUT OF REACH OF CHILDREN!

You can also desize your grey fabric using enzymes or oxidizing agents. However, these methods are carried out on large scale in organized textile mills. Therefore, these processes are not recommended for small scale processors.

Portfolio Activity 4.1

To test whether starch has been completely removed from the fabric

Complete removal of starch can be tested by iodine test. The steps involved in this test are:

1. Place a drop of iodine solution on the wet desized fabric (If the fabric is dried after desizing, wet out the dry fabric before putting drop of iodine solution)
2. Spread the iodine solution on wet fabric by slight rubbing action
3. Wait for 1 minute for the reaction to complete between residual starch and iodine

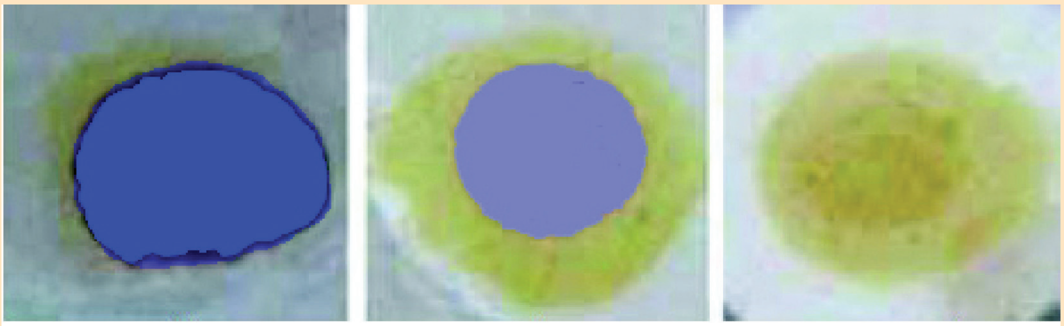
Iodine Solution is easy to prepare!

- Dissolve 6 gm of potassium iodide in 100ml water.
- Add 2 grams of iodine crystals to the above solution and stir with glass rod till iodine is completely dissolved.
- Store the solution in dark coloured glass bottle.

What do you observe?

Is there any change in colour of iodine solution on the fabric? Depending on the change in colour the extent of removal of starch can be predicted.

The change in colour is illustrated in the following picture:



Dark Blue Colour   Light Violet Colour   Light Brown Colour

Dark blue colour: No removal of starch. In this case, desizing process must be repeated

Light violet colour: Partial removal of starch. The fabric may be accepted for next process

Light brown colour: Complete removal of starch. Desizing process has been carried out efficiently.

Scouring

Though we have removed the size from the fabric, our fabric is yet not ready for dyeing and printing. Its water absorption capacity is very poor because it still has a uniform layer of wax on the surface of the fibres. This wax hinders the penetration of water, dyes and other chemicals in to the fibres, hence needs to be removed.

Wax from cotton fibres can be removed by treating cotton in an alkaline solution at high temperature. This process is known as scouring.

Purpose of Scouring

- Removes various impurities including wax and oil stains from cotton yarn/fabric.
- Improves water absorbency of cotton yarn/fabric.

Do not Forget!!

Good water absorbency is an essential requirement for uniform bleaching, dyeing and printing processes.

Scouring Recipe:

The choice of recipe and the process conditions depend on various factors such as type of fabric to be scoured, equipments and other facilities available. Each processor has to standardize his own recipe to get satisfactory results. Therefore, the following recipe may be taken only as a guideline.

Sodium Hydroxide:	3-4% owf
Sodium Carbonate:	1% owf
Wetting agent:	0.2-0.4% owf
MLR:	1:30-1:40
Temperature:	Boiling

NOTE: owf is the short form of 'on weight of fabric'. It is also written as owm (on weight of material). The amount of a chemical taken for any treatment would depend on the weight of the fabric. More is the weight of the fabric/material, more would be the chemical required.

For example, if the weight of fabric is 100 grams, 2% owf sodium hydroxide can be calculated as:

Weight of sodium hydroxide: 2% of 100 grams = 2/100 x 100 = 2 grams

Similarly, if the sodium hydroxide required is 4% owf and the weight of weight is 300 grams, then the weight of sodium hydroxide to be taken would be:

4/100 x 300 = 12 grams

You need to wash the fabric after scouring with cold water followed by hot water and then again with cold water. You can neutralize the pH of the fabric by making a very dilute solution of acetic acid (1%) or vinegar and rinsing the fabric in it followed by rinsing in water again.You may carry out scouring in open containers. However, the fabric should always be kept immersed in scouring solution. Exposure of fabric to air should be minimized as the fabric will lose its strength.

Drop Penetration Test

Scouring efficiency can be tested by placing a drop of water on the scoured fabric. If the drop takes 2-3 seconds to get absorbed by the fabric, it has been scoured properly. If the water droplet floats on the fabric for a long time and takes more than 2 minutes to absorb then scouring needs to be repeated.

Remember!!

Just like acids, alkalis also need to be handled carefully and disposed off responsibly.

Sodium Hydroxide is highly corrosive and requires same precautions while handling as mentioned for acids.

Use personal protection equipment while handling alkalis.

Before disposal, dilute the alkali and then neutralise it with hydrochloric acid before pouring into the drain.

Portfolio Activity 4.2

Collect five different fabric samples. Put a drop of water on these fabrics. Note the time taken by the fabric to absorb the drop of water.

FABRIC SAMPLES	DROP PENETRATION TIME
Sample 1	________________
Sample 2	________________
Sample 3	________________
Sample 4	________________
Sample 5	________________

Bleaching

After desizing and scouring, your fabric is ready to be dyed. However, if you want to dye your fabric in light shades or you want to print on light or white background, then you need to have a pure white fabric.

Cotton has a natural colour which does not get removed during desizing and scouring. Therefore, to get a pure white fabric you need to bleach the fabric. During bleaching the natural colouring matters present in cotton are decomposed to colourless substances. The removal of these colouring matters helps to improve the whiteness of cotton fabric.

Purpose of Bleaching

- To produce white fabric.
- To improve brightness of colour after dyeing and printing

BLEACHING IS AN OPTIONAL PROCESS. YOU DO NOT NEED TO BLEACH YOUR FABRIC IF YOU HAVE TO DYE IT IN DARK SHADE.

Bleaching Agents

The chemicals used for improving the whiteness of fabric are known as bleaching agents. These are primarily oxidising agents. (You have already learnt about oxidizing agents in Chapter 2). Although several bleaching agents are available, hydrogen peroxide is the most popular for bleaching of cotton.Hydrogen peroxide is available at 35% concentration.

At small scale, bleaching can be done in a stainless steel patila/open container.

Typical bleaching recipe for cotton is as follows:

Hydrogen peroxide (35%):	3-5% owf
Wetting agent:	0.1-0.5% owf
Sodium Hydroxide:	0.3-0.8% owf
Sodium silicate:	3-5% owf
EDTA:	0.5% owf
pH:	10-11
Temperature:	80-100ºC
Time:	1-2 hours

After the process is complete, drain the water; and then rinse with hot and cold water.

You can also use Sodium Hypochlorite to bleach the cotton fabric at room temperature. But it is recommended not to use sodium hypochlorite as it is not good for your environment and your aquatic friends in water bodies.

SAFETY MEASURES

Store Hydrogen Peroxide in cool, dark, well ventilated area in tight and light resistant containers.

Wear appropriate PPE (Personal Protection Equipment- Gloves, Goggles, Lab coat etc.)

Mercerisation

By now you have a fabric which is ready to be dyed or printed. However, if you want a cotton fabric or yarn that has still better dye uptake, you can go in for another treatment that is known as Mercerisation. It is one of the most important treatments given to cotton.

Mercerisation not only improves dye uptake, it also brings about significant improvement in the strength and shine of cotton yarns and fabrics.

Mercerisation is a process applied to cotton yarn or fabrics which improves the strength, lustre and dye uptake of cotton.

For mercerisation, cotton is treated with a strong caustic soda (sodium hydroxide) solution for a short period of time under stretch. Fabric is then thoroughly washed thoroughly and neutralised with dilute acetic acid to remove the caustic.

It is difficult to carry out mercerisation in small scale setups. There are specialised equipments for carrying out mercerisation.

Portfolio Activity 4.3

Go to a local shop and observe the labels/tags on 10-15 cotton fabrics and cotton sewing threads. Look for the term 'Mercerised' in the labels.

In how many fabrics/thread samples you could find the term 'mercerised'?

Know Your Progress 4.2

Q1. Match the following:

i.	Desizing	a.	Water absorbency
ii.	Bleaching	b.	Improved dye uptake
iii.	Mercerisation	c.	Size/starch
iv.	Scouring	d.	Hydrogen peroxide
		e.	Reactive dyes

Q2. Fill in the blanks:

i. Presence of starch on a fabric can be determined by ________ test.

ii. Wax from cotton fabrics can be removed by _____________ treatment.

iii. Water absorbency of a fabric can be measured by ____________________ test.

iv. Bleaching improves ______________ of a fabric.

v. Mercerisarion is carried out by treating cotton with __________ solution.

Q3. Enlist the three effects of mercerisation on cotton

i. ________________________

ii. ________________________

iii. ________________________

Fill your score ______ / 24

4.3 PREPARATORY PROCESSES FOR SILK

Apart from cotton, silk is another fibre which is manufactured, dyed and printed at the cottage level. Silk has a very pleasing lustre/sheen. It is a very expensive fibre and is known as the 'Queen of fibres'.

Do You Know

- India is the second largest producer of silk, China being at the top!
- India is the only country producing all varieties of silk: Mulberry, Tassar, Muga and Eri!

Degumming of Silk

Raw silk has a layer of gum (sericin) over its fibres. This layer of gum makes the silk yarns and fabrics stiff and dull in appearance. This gum has to be removed to get a shiny, smooth fabric, which is generally used for dyeing and printing.

The gum from silk is removed by the process known as Degumming.

Our well known Chanderi silk sarees are woven from fine un degummed silk yarns to achieve the characteristic stiffness.

Degumming silk is usually carried out under mild alkaline conditions using soap. However, recently protease enzymes are also suggested for silk degumming.

Traditionally, olive oil soap, known as Marseille soap, is used for degumming. The alkaline pH of soap and its cleansing action not only remove sericin but also remove natural waxes and oil stains. Sometimes, sodium bicarbonate or sodium carbonate (pH 10) is used along with soap.

The typical degumming recipe and process conditions are:

- Marseille soap (olive oil soap) solution: 25% owf
- Temperature: 90ºC -95ºC
- Time 1-2 hours

After degumming, wash with hot and cold water to remove the gum and other chemicals.

If Marseille soap is not available, then normal soap with low alkalinity can be used. However, the process conditions must be standardized depending on the quality and alkalinity of soap used.

It is Interesting to know!

Silk has about25-30% gum on it. Degumming results in approximately 20-25 % loss in the weight of silk. This loss in weight has to be accounted for when determining the cost of silk as silk is sold and bought by weight.

Sericin removed from silk is not discarded. It has many desirable properites, such as, antimicrobial property, ultra violet ray protection etc. Therefore, its use is being explored in textile finishing as well as in medical applications. Degummed solution can also be used in bleaching.

Bleaching of Silk

As with cotton, even in case of silk, you might need to have a white material for dyeing and printing. Silk also may have a natural colour which varies with the type of silk.

Most of the colour in silk is present in sericin. With degumming this colouralso gets removed. However, degumming does not remove complete sercin, therefore some colour remains on silk.

> Tassar silk comes in varied shades of brown!
>
> Eri silk can be brick red in colour!
>
> Murshidabad silk is bright yellow in colour!

Silk can also be bleached with hydrogen peroxide. However, unlike cotton, silk gets damaged by strong alkaline conditions.

(RECALL: Do you use the same detergent to wash your silk that you use for washing your cotton clothes. Which detergent do you use for your silks??)

Silk can be bleached using following recipes:

PARAMETERS	MULBERRY SILK	TASSAR SILK
Hydrogen Peroxide (35%)	15-20 ml	20-30 ml
Stabilizer	2 g/l	4 g/l
pH	8.5-9	8.5-9
MLR	1:30	1:30
Temperature	75-80 ºC	80-90 º C
Time	1-2 hours	2-3 hours

1. The alkali used is either ammonia or tetra sodium pyrophosphate. Sodium silicate added as the stabilizer should be avoided as it can render silk harsh.
2. Material must be thoroughly washed to remove all the chemicals after bleaching.
3. Do not use chlorine based bleaches for silk and wool as they damage protein fibres.
4. After degumming and bleaching, silk yarns/fabrics are ready to be dyed or printed.

Know Your Progress 4.3

Q1. Fill in the blanks:

i. Silk has a coating of gum over it which is called ___________.

ii. Process of removing gum from silk is known as ___________.

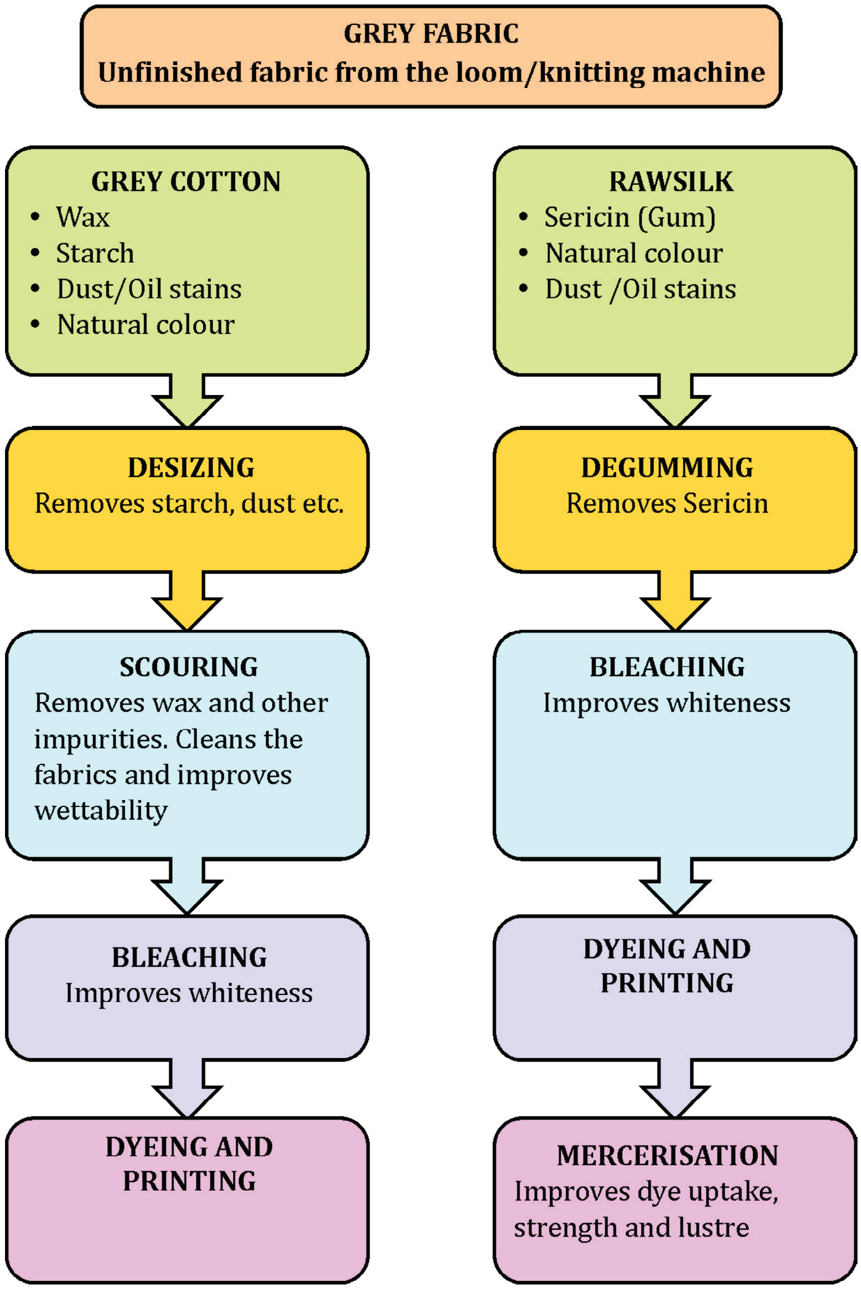
iii. Bleaching of silk can be carried out by using ____________.

iv. Silk gets damaged by strong _______________ pH.

Q2. List various varieties of silk.

Fill your score _____ / 10

4.4 THIS IS WHAT YOU HAVE LEARNT



4.5 LET US PRACTICE

1. Why is the preparation of grey fabrics required?
2. List the various processes required for preparing grey cotton fabric for dyeing and printing.
3. What is the purpose of degumming? Explain in 2-3 lines.

4. Match the following:

i. Mercerisation	a. Marseilles soap
ii. Bleaching	b. Hydrochloric acid
iii. Degumming	c. Sodium Hydroxide
iv. Desizing	d. Hydrogen Peroxide

4.6 ANSWERS TO KNOW YOUR PROGRESS

4.1:

Q1. i) Grey fabric

ii) Preparatory processes

iii) Fibre

Q2. i) Remove impurities,

ii) Improve water absorbency

iii) Improve fabric appearance

4.2:

Q1. i-c, ii-d, iii-b, iv-a

Q2. i) Iodine ii) Scouring

iii) Drop penetration iv) Whiteness

v) Sodium hydroxide

Q3. i) Improved dye uptake

ii) Improved strength

iii) Improved lustre

4.3:

Q1. i) Sericin ii) Degumming

iii) Hydrogen Peroxide iv) Alkaline

Q2. Mulberry, Tassar, Muga, Eri

Fill your score ______ / 46

PRACTICAL WORK

Practical 4.1

Aim: To desize a grey cotton fabric by Rot Steeping method.

Material Required: Grey fabric (Markin), Water, Steel Patila, Iodine Solution.

Procedure:

1. Take around half meter of grey cotton fabric (you can buy markin from your market). Cut four 10 x 10 inch square pieces from it.
2. Keep one piece as original grey fabric. Soak three pieces in water in the steel patila and leave for 24 hours. Keep stirring in between and make sure that the fabrics remain immersed in water.
3. Ensure there is enough water for the fabrics to be immersed properly.
4. After 24 hours, remove the fabric pieces and wash them thoroughly in water.
5. Carry out the Iodine Test to find out if the starch has been removed completely.
6. Observe the differences between original grey fabric and desized fabric.

CLUE: Is there any difference in colour, softness, stiffness of untreated and desized fabrics?

Practical 4.2

Aim: To determine the scouring efficiency by drop penetration test.

Material Required: Three desized fabric pieces from Practical 1, Sodium Hydroxide, Sodium Carbonate, Wetting Agent (Lissapol or any liquid detergent), 1% Acetic Acid solution or dilute vinegar solution.

Procedure:

1. Take two of the three desized samples and keep one aside.
2. Weigh the two samples and based on their weight, prepare the scouring solution as per the recipe given in the text.
3. Carry out scouring in stainless steel vessel (patila) at boil for 1 hour.
4. Wash and neutralise the samples.
5. Dry the samples.
6. Take all the three samples-original grey fabric, desized fabric, desized and scoured fabric.
7. Put a drop of water on them and note the time taken by the drop of water to get absorbed by the fabrics. Record your observations.
8. What difference do you find between the drop penetration times of the three fabrics?
9. Compare the appearance and softness of the three fabrics.

Practical 4.3

Aim: To bleach cotton with Hydrogen Peroxide.

1. Take the two scoured fabrics from the previous practical.
2. Keep one scoured sample aside and bleach the other one with hydrogen peroxide using the above recipe.
3. Compare the whiteness of the unbleached and bleached fabrics visually.

Did you know !!!

POCHAMPALLY

Tie and dye art has been practised in many techniques to produce incredible effects with different colours.

Pochampally or Pochampalli Silk is a type of silk originating from the town of Boodhan Pochampally, located in Nalgonda district of Andhra Pradesh, India. The town is popularly known as the silk city of India.

Process: The distinctive fabric of Pochampalli ikat is an exemplary piece of ancient tie and dye technique that creates patterns or designs on the yarn through resist dyeing process. This is done before dyeing and weaving the fabric. Once the threads are dyed, the resists are removed to reveal the design, which is then woven into ikat fabric. The fabric is cotton, silk and sico – a mix of silk and cotton. This means the weaver should know where the threads need to be dyed so that it forms a proper pattern when woven on the loom.

History: This aesthetic artwork traces its origin to the 18th century, the era, which witnessed the mystic beauty of this fabric emerging out of the Pochampally town. This town had 80 villages under its wing, which initiated this artwork with traditional looms.

Production centres: Telangana is one of the ancient Ikat weaving centers in India, along with Gujarat and neighboring Odisha.[3] Today, most of weaving takes place in Pochampally village where there are over five thousand looms producing this textile.[3] It has found place in UNESCO tentative list of world heritage sites as part of "iconic saree weaving clusters of India".

5. Art of Dyeing

KEYWORDS

- Dyeing recipe
- Dye Bath
- On Weight of Fabric (owf)
- Dyeing cycle

OBJECTIVES

- To select the right dyeing process for application of selected dyestuff on different fabrics/yarns.
- To recognise the correct method of preparing the dye bath with the right quantities of water, dye and auxillaries.
- To indicate the correct dyeing procedure.
- To determine the correct method of disposal of consumed dye bath.
- To specify the need for washing and after treatment after dyeing.

Let's now learn the process of dyeing with the different dyes.

5.1 CHOOSING THE CORRECT DYEING PROCESS

We have been asked to dye a fabric given to us. What all do we need to consider before we finalise how it is to be done? Let's make a list of all questions we need answers to before we decide how we are going to dye. Please feel free to add any question that you think should also be asked. !

1. What fibre is this fabric/yarn made of ? Is it a natural or a man made fibre? Which exact fibre family does it belong to.
2. Which colour does the sample have to be dyed in?
3. Where is this going to be used? Is it for wearing or just for decorative uses?
4. What infrastructure is available for carrying out the dyeing?
5. ____?

Do You Remember?

Different dye classes are suitable for different textile fibres (Unit 1) because they have different compositions. Fibres which have similar compositions, can be dyed with the same dye classes! You may also remember that each dye class is available in a definite colour range and so the colour desired will also decide which dye class should be used.

Different types of dyes also have their unique fastness properties and thus depending on how much the fabric/yarn will be exposed to washing, light etc. the dye class will have to be chosen.

Could you think of another question to be asked?

May be….

How much money can you spend in dyeing your fabric or yarn??

Yes, Each dye class has a different cost to it and the cost factor must also be considered while choosing the dyeing process

So finally you have decided the dye that you would be using. Each dye class is to be used with a prescribed dyeing recipe. This is very similar to the recipe of anything you cook in the kitchen. The **dyeing recipe** mentions mainly 3 thing:

1. Ingredients (water, dye, auxiliaries)
2. Quantity of ingredients
3. Process to be adopted.

Know Your Progress 5.1

Let's Recall !

Q1. Match the enteries in column A to those in column B: !

	Column A	Column B
1.	Cellulosic fibre	(a) Silk
2.	Synthetic fibre	(b) Wetting agent
3.	Acid dye	(c) Poor colour fastness
4.	Direct dyes	(d) Linen
5.	Auxillaries	(e) Disperse dyes
		(f) Vatting

Fill your score ______ / 10

5.2 SETTING THE DYE BATH

Once you have this dyeing recipe, now lets look at the next steps. Here is a checklist of the things you would need along with their quantities. The water that is to be used for dyeing with the dissolved dye and any other ingredient that may be required is called the **Dye bath.**

1. **Dye:** This is usually in the powder form. Just like the amount of salt we put in the dal depends on how much dal we are cooking, the amount of dye you take is according to the weight of fabric you are dyeing and if you are using a light, medium or dark shade. The amount of dye is calculated based on the prescribed % **owf** (on weight of fabric).

Weigh the fabric

↓

Convert the weight in grams

↓

Amount of dye = OWF/100 *weight of material in grams

2. **Water :** The water to be taken is also dependent on the amount of material being dyed. Take a look once again at the term MLR in unit 2. MLR stands for the Material to Liquor Ratio. The MLR to be used for each dye and fibre type will be shared with you in the next segment. Once you know the MLR to be used, just simply multiply the material weight (in grams) to this MLR to get the water required in millilitres.

Material weight (gms) X MLR = Millilitres of water

3. **Auxillaries:** As you read in unit 2, during the dyeing process depending on the dye class and the fibre type certain chemicals may be required which support the dyeing process and help in fixation of the dye to the fibre. Please recall that these were known as Auxillaries. The amount of these is calculated as per the prescribed % owf in the dyeing recipe or as per the volume of dye bath indicated as the gpl (g/l or grams per litre).What else do you need to begin dyeing apart from the dye, water and auxillaries?? Put a tick against the item that you have arranged for.

Item	Tick
1. A vessel/ pateela- Should be large enough that the material to be dyed ca be comfortably circulated in it	
2. A laddle/ karchi - For stirring the material	
3. Few small bowls- For pasting the dye etc.	
4. A heat source- Preferabaly LPG. It should cause least environmental pollution. It should allow for temperature regulation	

Know Your Progress 5.2

Lets Calculate

Q1. You have a 400 grams cotton fabric to be dyed. Calculate the amount of dye and water required if the dye has to be 4% owf and the MLR is 1:30.

Q2. A certain dye bath has to contain 20 gpl of salt. How much salt do you need to put if the volume of the bath is 2.5 litres.

Fill your score ______ / 4

While adding auxiliaries to the dye bath, take care of the following:

- The auxiliaries are mixed thoroughly and homogeneously in the dye bath.
- If the auxiliary is being added during the dyeing process, it should not be allowed to fall on the material being dyed, otherwise it may lead to uneven or patchy dyeing.

5.3 DYEING CYCLE

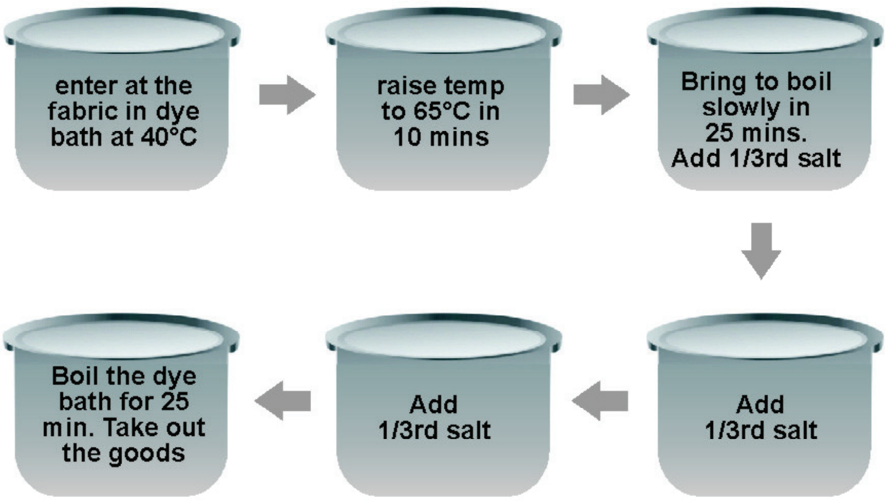
Before you begin to dye, go through the following steps: !

1. Weight the fabric
2. Soak the material in clean water
3. Calculate the amount of dye and other auxillaries
4. Weigh the required amount of dye and auxillaries
5. Paste the dye suitably
6. Take the right amount of soft water in the dyeing vessel as per the MLR
7. Set up the dye bath as prescribed
8. Begin dyeing as per suggested procedure

1. Direct dyes on cellulosics

M.L.R:1:30 Dye: Light shades- 2% owf Medium shades- 4% owf Dark shades- 8% owf ! Lissapol N- To paste the dye	Sodium carbonate (Na_2CO_3): Light shades- 1% owf Medium shades- 2% owf Dark shades- 3% owf ! Common salt (NaCl)- Light shades- 5% owf Medium shades- 10% owf

Prepare the dye bath with the pasted dye stuff and the measured amount of Sodium Carbonate. Divide the common salt roughly in 3 parts. Salt is added in 3 steps to get even dyeing Follow the dye cycle below.



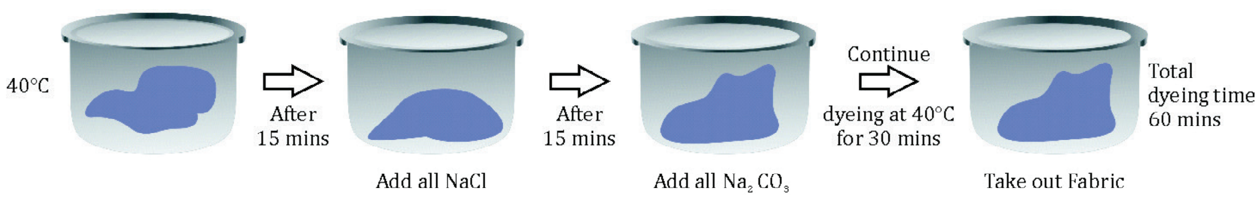
After dyeing soak the fabric/yarn in a soap solution at room temperature to remove any unforced dye. Rinse well afterwards.

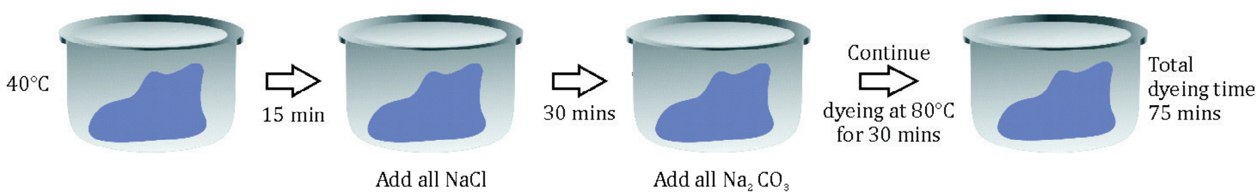
2. Reactive dyes on cellulosics

Reactive dyes commonly available in the market are of two types: Medium brand and hot brand. The method of dyeing of these is slightly different from each other

Paste the measured dye in a little TRO and add to the required quantity of water to prepare the dye bath. Follow the dye cycle below.

M.L.R:1:30 Dye: Light shades- 2% owf Medium shades- 4% owf Dark shades- 8% owf TRO: To paste the dye	Sodium carbonate (Na_2CO_3): Light shades- 3 gpl Medium shades- 4 gpl Dark shades- 5 gpl Common salt (NaCl): Light shades- 40 gpl Medium shades- 50 gpl Dark shades- 60 gpl



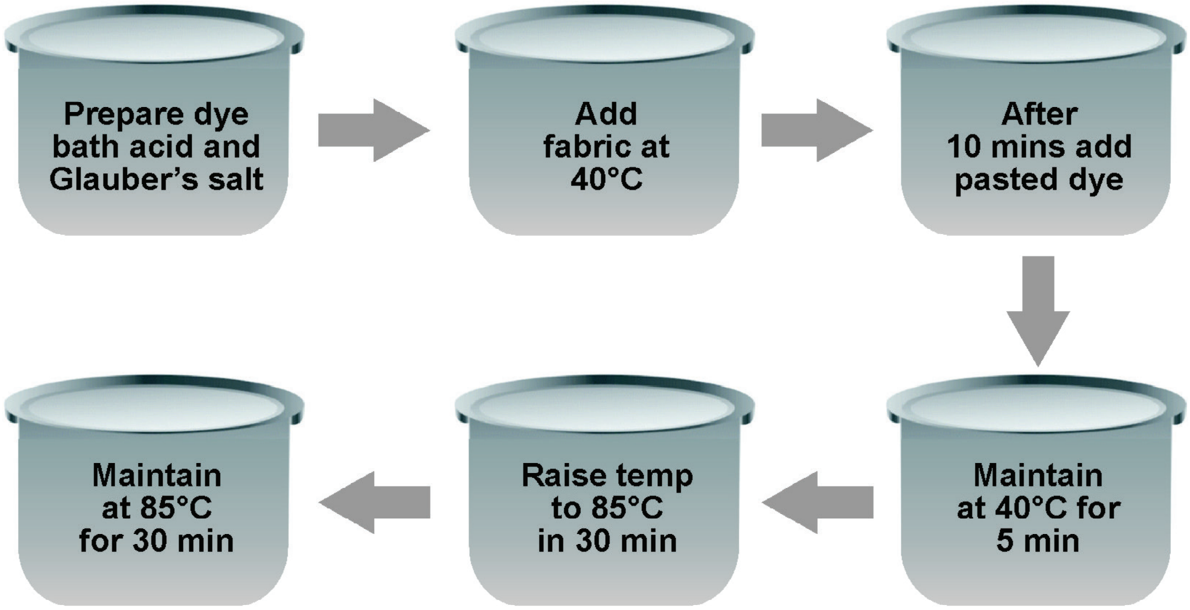


The dyed fabric must be boiled well in a mild soap solution for about 10-15 minutes.

3. Acid dyes on silk

M.L.R: 1: 80 Dye: Light shades- 2% owf Medium shades- 4% owf Dark shades- 6% owf Lissapol N: To paste the dye	Glaubers salt: 20% owf 30% acetic acid: 5% owf

Paste the dye in a few drops of lissapaol N and some warm water. Prepare the dye bath by adding the Glaubers salt and the acid but not the dye.



Remove goods and rinse

Soke the samples in a mild soap solution at room temperature. Rinse well afterwards.

4. Vat dyes on cellulosics

Vat dyes are quite different than other dyes that you have read about above. Unlike other dyes, the vat dyes don't dissolve in water !!!!and hence can't be applied on the textile material. These need to be prepared for their application to the textile. Once on the fabric/yarn, they are again converted back to their original form.

MLR: 1:30 Dye: 4% owf Sodiun Hydroxide (NaOH): 6 g/l	Sodium Hydrosulphite: 4 g/l Common Salt: 10 g/l

The dyeing with Vat dyes is carried out in 3 phases !!

VATTING → **DYEING** → **OXIDATION**

Vatting: The measured quantity of dye is pasted with TRO and 1/4th water, 2/3rd common salt and 2/3rd sodium hydro sulphite are added from the measured quantities. The mixture is allowed to remain for 10-15 mins at 55°C. Most vat dyes change their colour on vatting. !

Dyeing: Prepare the dye bath using remaining 3/4th liquor, remaining common salt and hydrosulphite. Add the vatted dye stuff and NaCl to the dye bath. Heat the dye bath to 55°C and enter the fabric to be dyed. Let the material lie in the dye bath for about 50-60 mins at this temperature. Be sure to stir the material frequently.

Oxidation: Remove the fabric from the dye bath, squeeze, rinse well and spread in the open air during which the colour will develop in the fabric.

Always remember to boil the vat dyed fabric in a mild soap solution for 5 minutes to remove any dye which is only attached to the fabric surface.

5. Sulphur dyes on cellulosics

Sulphur dyes are also not soluble in water in the form in which you buy them from the market and have to be given a treatment to solublise and apply them. After application they need to be processed to bring back the colour. This treatment could be simply spreading the material in the open or giving a chemical treatment.

STEP 1- DYEING	STEP 2- OXIDATION
MLR: 1:30 Dye: 4% owf 6% owf (for black) Na_2CO_3: 0.5 X amount of dye Sodium Sulphide: 2 X amount of dye 0.5 X amoubnt of dye Common salt: 20% owf TRO: for pasting	Sodium Perborate: 2 gpl 1 % acetic acid solution

Paste the measured dye with sodium carbonate and a little cold water → Add sodium sulphide (twice the amount of dye) and boiling water → Boil the solution till it becomes clear and strain → To make the dye bath, take the re-maining water. Add to it sodium sul-phide (Half the wt of dye). Heat the bath to 600 C. Add the dye solution

↓

Add the pre-soaked fabric. Mix well. Keep for 2 minutes

Add salt in 3 installments

20 Minutes

Bring Dye bath to boil in 20 mins

45 Minutes

Continue to boil dye bath for 45 mins. → Remove the fabric and rinse well. → Spread the fabric out-side in the open

OR

Make a oxidis-ing bath and soak the fabric in it for about 5 minutes.

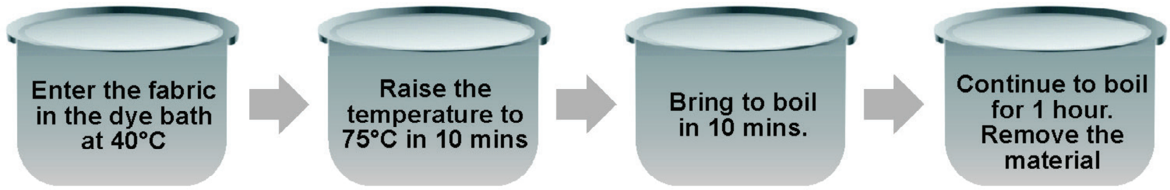
After the colour develops boil the material in mild soap solution for 15 minutes

6. Basic dyes on acrylic

M.L.R: 1:40	30% acetic acid: 3 gpl
Dye: 4% owf	Sodium acetate: 3 gpl

For basic dyes, when you are pre soaking the fabric, add a few drops of acid to the bath. It will definitely give you better results in dyeing.

Paste the measured dye in few drops of acetic acid and warm water. To the measured water add the measured acetic acid, sodium acetate, the pasted dye and the dye bath is ready!! You can begin to dye.



Do remember to soap the basic dyed sample at boil for 5-10 mins.

7. Azoic Dyes on cellulosics

Azoic dyes are a very interesting class of dye. Will you believe, they can dye the fabric at only room temperature and within a few minutes. These dyes give colour by the coming together of two parts and so dyeing with them includes a two step process. Two dye baths have to be made, one for each part. The fabric to be dyed is dipped in the 1st bath and then in the 2nd bath. Neither of these baths show any colour, but as soon as these combine, colour develops almost like MAGIC !!!

You will be interested to know that though these dyes give beautiful colours almost instantly, They are now considered unsafe and are banned from usage specially for exports. These are known to cause skin cancer and should never be used for fabric that is to be worn.

Know Your Progress 5.3

Fill in the blanks:

Q.1 MLR for dyeing silk with acid dyes is __________

Q.2 ________, ___________, ___________ are the 3 phases of dyeing with Vat dyes.

Q.3 In direct dyeing, salt is added in 3 steps to get ____________ dyeing.

Q.4 A class of dyes which are banned to be used for clothing is ____________.

Q.5 Amount of dye required depends on weight of material and ____________.

Fill your score _______ / 10

5.4 DISPOSAL OF DYE BATH

Have you ever thought about the importance of clean water in our lives?? Can you imagine the difficulties if all water around us was polluted?? Would it be possible for us or other animals or plants to survive??

I am sure you all agree that such a situation will not only be very scary but also impossible to survive in. So we all agree that clean water and environment is most important for our health and survival. Hence, it is the duty of each one of us to save our earth from this pollution.

You must be thinking that why all of a sudden we are discussing clean water? Now, just look back at all the dyeing we did. Once you completed the dyeing process, you are happy as you get your dyed fabric/yarn. Now you get down to cleaning your work area and you need to clean your dyeing vessel. For this the first thing you will need to do is throw away the left over dye bath. How and where should we do this?? Take a minute to think….. What are the options? Lets have a look and choose what you think is appropriate.

1. Throwing the used dye bath in a drain
2. Throwing the used dye bath in a farm area
3. Throwing the used dye bath in an open land
4. Using it for watering plants
5. Can you think of anything else??

To tell you the truth, none of these is a perfect method. But some of the above are to be totally avoided. One should never dispose off the used dye bath in open fields or farms or use it to water plants. This not only is very harmful for the plants but it also seeps underground and pollutes the underground water, which is the water we use finally as drinking water.

A better option is to throw the used dye bath into our house hold drains. Usually this sewage water is sent to treatment plants, where the water is treated to remove pollutants and finally the clean water is thrown into water bodies. This is the most ideal means when dyeing at small scales.

If you plan to run large scale dye houses, then it is mandatory to install a ETP (Effluent treatment plant). Here the waste water of the dye house if first treated to remove pollutants and finally disposed off.

Know Your Progress 5.4

Q1. The two most harmful effects of disposing off used dye bath in farms or field are, ____________________ and ____________________

Q2. In large dyeing houses the used dye bath is treated in a __________________ before being disposed off.

Fill your score _______ / 6

5.5 PROPER WASHING OFF

RANG: “Rangili, why are you wasting time in this washing. You have already dyed. Lets sell this in the market.”

RANGILI: “Hold on!! I am not wasting time. I am washing off any extra dye so that my customers don’t experience colour loss when they use my fabrics”

In all the dye recipes that have been shared with you above, the method of washing off the material after dyeing has also been mentioned. Beware!! that this washing off is as important as the actual dyeing. The main purpose of this after washing is to remove any dye that is just lying on the surface and hasn’t fixed to the textile. This has to be removed as otherwise when you use clothes made from this material, there will be colour bleeding when you wash your clothes after using.

Do follow these precautions while dyeing

1. Use soft, clean water.
2. Use a large enough container so that the material can be stirred easily.
3. All material being dyed should be in an open state.
4. Stir the material frequently.
5. The material being dyed should be immersed in the dye bath completely at all times.
6. Mix any auxiliary being added well into the dye bath.
7. After dyeing, rinse, soap and wash the dyed material thoroughly
8. Dispose off the used dye bath with extreme caution.

Know Your Progress 5.5

Q1. You experience that a shirt that you bought, bleeds colour when you wash it. A few reasons for this is listed below. Tick mark the ones that you think may be true.

(i) Proper dyeing time was not followed.

(ii) Proper dyeing temperature wasn’t maintained.

(iii) All auxillaries required fir dyeing were not added.

(iv) Proper after washing of the dyed fabric wasn’t done.

(v) The dye used has poor fastness properties.

Fill your score _______ / 10

Portfolio Activity 5.1

Visit a local dyer. Make a note of all the steps he/she is using to carry out the dyeing. Fill the observation sheet below.

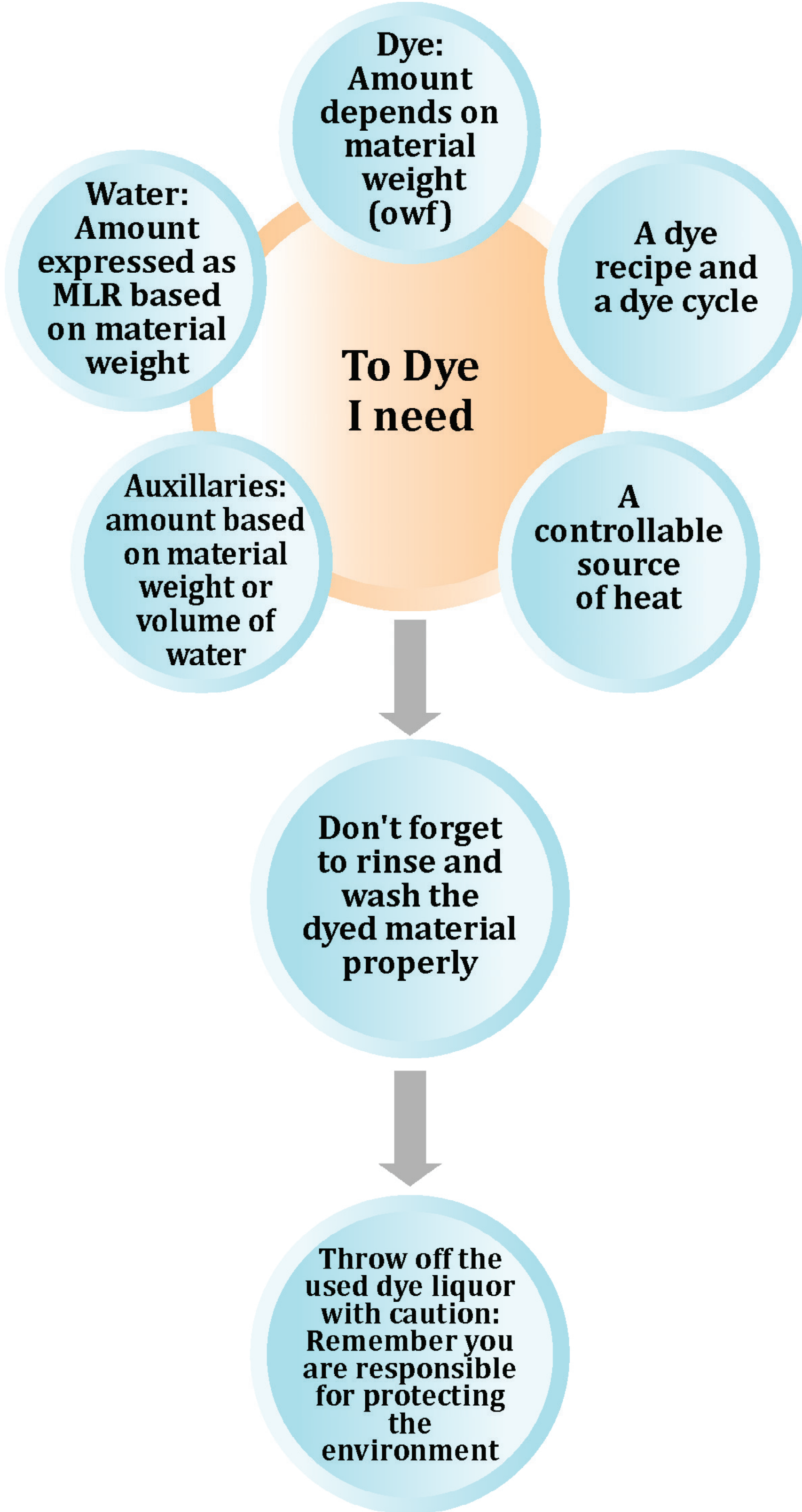
OBSERVATION POINTS	REMARKS
Fabric being dyed	
Dye being used	
Auxillaries being used	
Dye source	
Auxillaries source	
Source of heat. Is the heat controllable	
Is the quantity of material, dye etc. being measured	
Washing off process	

Portfolio Activity 5.2

Market Survey : Make a visit to the shops selling dyes in your surrounding areas. Fill out the comparative cost sheet below:

S. No.	Dye Name	Dye class	Colour	Cost/100gm	Fiber for which used
1.					
2.					
3.					
4.					
5.					

5.6 THIS IS WHAT YOU HAVE LEARNT



5.7 LET US PRACTICE

Short Answers (40-50 words)

Q1. List the factors to be considered for choosing a suitable dyeing process.

Q2. List the components of a dyeing recipe.

Q3. Explain the importance of the washing off process after dyeing.

Q4. Indicate the two methods of oxidation after dyeing with sulphur dyes.

Long Answers (100-150 words)

Q.1 Describe the process of preparation of the dye bath for dyeing with Direct dyes.

Q.2 Indicate the difference in the dyeing process between medium brand and hot brand reactive dyes.

Q.3 List the common steps to be followed before undertaking any dyeing process.

5.8 ANSWERS TO KNOW YOUR PROGRESS

5.1

Q.1 1. d, 2. e 3. a
4. c 5. b

5.2

Q.1 Dye= 16 gm, Water= 12 liter

Q.2 50 grams

5.3

Q.1 1:80
Q.2 Vatting, Dyeing, Oxidation
Q.3 Even
Q.4 Azoic colours
Q.5 Depth of shade

5.4

Q.1 All of these may be the possible reasons.

5.5

Q.1 a. Causes damage to plant life
b. Pollutes underground water table
Q.2 Effluent treatment plant (ETP)

Fill your score ________ / 40

PRACTICAL WORK

Practical 5.1

Aim: To dye the cotton fabric with direct dye.

Material Required: Direct dye, Cotton fabric, Lissapol N, Na_2CO_3,NaCl.

M.L.R:1:30 Dye: Light shades- 2% owf Medium shades- 4% owf Dark shades- 8% owf Lissapol N- To paste the dye	Sodium carbonate (Na_2CO_3): Light shades- 1% owf Medium shades- 2% owf Dark shades- 3% owf Common salt (NaCl): Light shades- 5% owf Medium shades- 10% owf Dark shades- 20% owf

Material Weight (gms)	MLR (ml)	Dye ___% owf	Na_2CO_3___%owf	NaCl ___%owf

Procedure:

1) Fabric for dyeing is weighed and soaked for 15-20 minutes in water before dyeing.
2) Required amount of dye is pasted with lissapol and little amount of water.
3) This dye paste is then added to the measured amount of water (according to M.L.R)
4) The fabric to be dyed is entered into the bath at room temperature of 40-45°C. The temperature is then gradually raised to 65°C in 10 minutes.
5) The temperature is maintained for 10 minutes at 65°C.
6) It is then brought to boil (100°C) in the next 15 minutes.
7) Now,the salt is added in three instalments with the gap of 5 minutes each.
8) After the 3rdinstallment, bath is then maintained to boil for 20-30 minutes.
9) Fabric is then removed and rinsed thoroughly in running water.
10) After rinsing, soaping is done at room temperature with lassapol for 5 – 10 minutes, and fabric is kept to dry.

Practical 5.2

Aim: To dye silk with acid dyes

Material Required: Silk, Water, Acid dye, Glauber's salt, Acetic acid (30%), Lissapol NM.L.R:1:80

M.L.R:1:80 Dye: Light shades- 2% owf Medium shades- 4% owf Dark shades- 6% owf Lissapol N - To paste the dye	Glaubers salt: 20% owf 30% acetic acid: 5% owf

Material Weight (gms)	MLR (ml)	Dye ___% owf	Glaubers salt	Acetic acid

Procedure:

1. Take the required amount of dye and paste it with a few drops of lissapol and warm water.
2. In a beaker, take the required MLR and add Glauber's salt and acetic acid to it.
3. Raise the temperature to 40^{0} C
4. At 40^{0} C, add the fabric to this beaker and run in this liquor for 10 minutes.
5. After 10 minutes, add the dye paste to the liquor. Maintain the temperature at 40^{0} C for 5 minutes.
6. For wool, raise and maintain the temperature of the bath at 100^{0} C for the next 45-60 minutes.
7. For silk, raise and maintain the temperature of the bath at 80^{0} C for 45-60 minutes.
8. Rinse the fabric well.
9. Soap thoroughly in lissapol N at room temperature for 5 minutes.

Did you know !!!

PATOLA

- **Patola** (singular – patolu), woven in silk in Gujarat, is a kind of double ikat, wherein the warp and weft yarns are dyed separately by the tie and dye process prior to weaving in such a way that the dyed areas of the yarns come together in a wonderful manner to shape the pre-conceived design.
- **History:** Historically, the art of double ikat patola weaving dates back to centuries. Painting in Ajanta caves, resemble the tie-dye technique of patola. Legend indicates that sometimes in the 12th century A.D. king kumarpal of solanki dynasty invited 700 families of patola weavers from jalna (south Maharashtra) to settle down in patan in north Gujarat.
- **Motifs:** There are some 10 basic patterns, mainly of plant, zoomorphic and geometrical motifs. The designs most commonly found include Chhabdi bhat (the basket pattern); Fulvali bhat (flowering pattern); Ratan chowk bhat (jewel mosaic –floral motifs in geometrical forms); Paan bhat (pipal leaf pattern) to name a few.
- Unique feature of patola is that it has no reverse side and the patterns emerge evenly on both faces.
- This exceptional technique demands an incredible degree of skill and precision and is expensive.

A common saying in Gujarat is:

'Pade patole bath fate pan fite nahin'

(Someone who is steadfast and honorable is like the patola"
where the design may tear but the colour will never fade"

6. Printing Patterns on Textiles

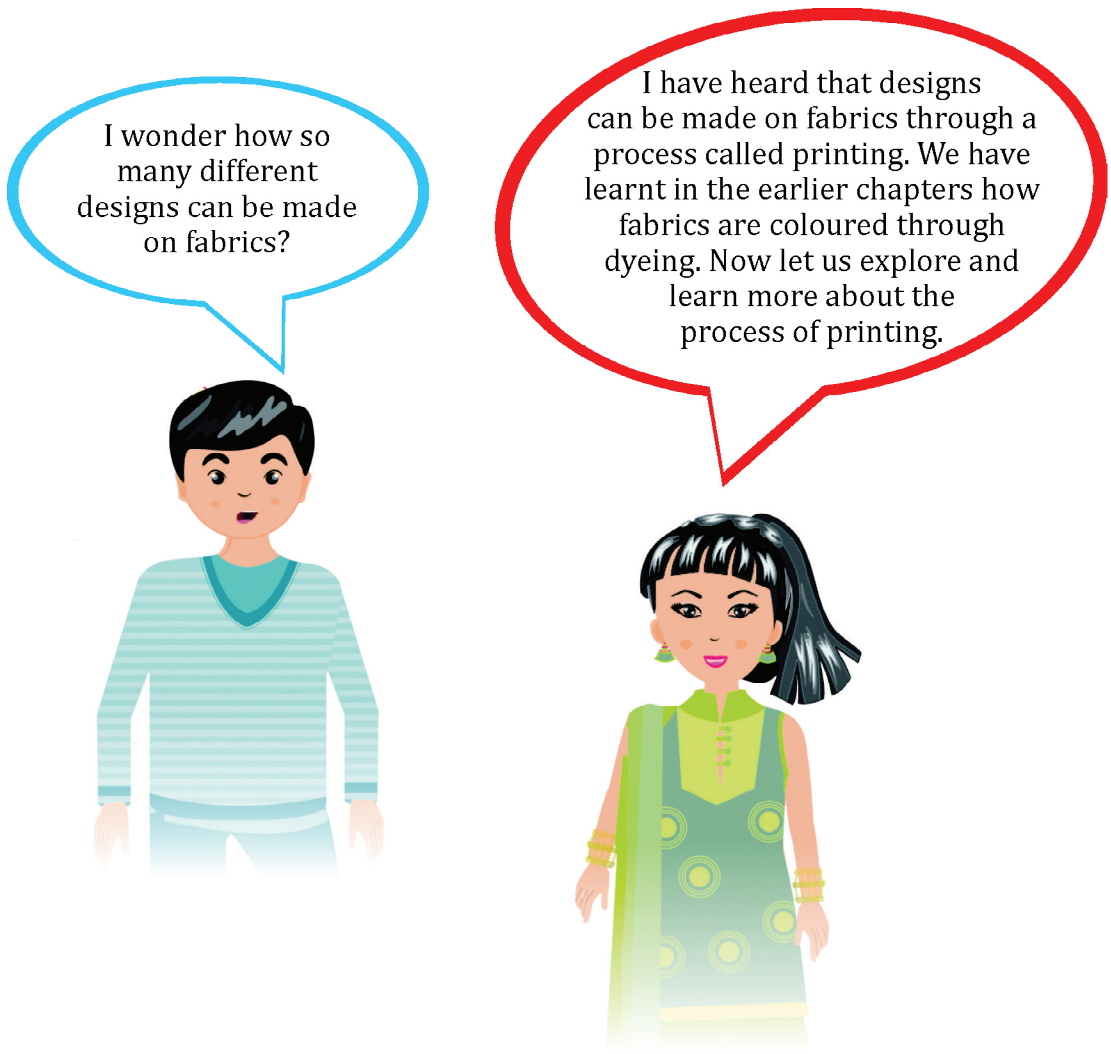
KEYWORDS

- Textile printing
- Print paste
- Auxiliaries
- Block printing
- Screen printing

OBJECTIVES

The students will be able to:

- Define printing
- Enlist the components of a print paste and explain their functions
- Explain different methods of printing
- Differentiate between Block printing and Screen printing
- Determine the need for dye fixation and washing



6.1 PRINTING ON FABRICS

When you apply dye/pigments on the fabric in the form of designs the process is called printing. The dye/pigment is applied to the fabric in the form of a paste and is restricted to the design area. Therefore, printing is also called **localised dyeing**.

Have you noticed that a small unit of the design is printed repeatedly in the fabric to form the pattern? This small unit of the design is known as a **repeat.** You also must have observed that sometimes the same print is available in different colour combinations. These different colour combinations are known as **colourways** which increase the choice for the consumer. Printing is an inexpensive method of increasing the attractiveness and creating variety of fabrics for the consumers.

> Application of dye/pigments on fabrics in the form of a repetitive pattern or design is known as Printing

CAN DYED FABRICS ALSO BE PRINTED?

You will be amazed to know that the art of printing is thousands of years old. India has been famous throughout the world for producing beautiful printed fabrics since centuries. Printing is now carried out in India at the cottage level as well as in factories to meet the consumer's needs. Many of the tasks relating to printing in big factories are now done with the help of computers.

Some of the famous cotton prints produced in India in the 18th century were called **Chintz** or **Chint**.

Porfolio Activity 6.1

Make a visit to your local shop selling fabrics and find out the number of prints available in different Colourways. Collect samples of two prints in different Colourways. Do different colourways of the same print cost the same?

Know Your Progress 6.1

Fill in the blanks with appropriate words:

i) Printing is also referred to as ——————— dyeing.

ii) In printing, the dye is applied to fabric in the form of _____.

iii) Printing produces—————— patterns on fabric.

iv) Printing is a _______ method of producing variety of fabrics.

v) Small unit of design printed repeatedly to form a pattern is called ——————.

vi) Cotton prints produced in India in the 18th century were called ______.

Fill your score ______ / 12

6.2 COMPOSITION OF A PRINT PASTE

As mentioned earlier, printing involves application of dye/pigment on fabric in the form of a paste. The print paste is a thickened medium for transfer of dye onto the fabric in the form of a pattern or motif. The print paste used for printing not only contains the dye, but also other auxiliaries essential for transfer and fixation of dye on the fabric. Different types of dyes and fabrics require different auxiliaries for fixation of dye on the fabric.

The choice of auxiliaries for making a print paste will therefore depend upon the following factors:

- The type of fabric to be printed eg. cotton, silk, nylon, etc.
- The type of dye used eg. direct, acid, reactive, etc.
- The method used for printing

Thickening agents are the main components of the print paste. Have you observed your mother making *pakoras*? She first makes a thick paste of flour and then adds all other ingredients to it. Similarly, the thickening agent forms the thick, viscous base for the print paste. All other auxiliaries are added to the thickener. Thickening agents may form upto 90% of the print paste. They are the most important auxiliaries for the print paste as they enable the dye to be localised within the desired area forming the design. They prevent spreading of the dye in the background areas of the print.

A thickening agent should have the following desirable properties:

- It should be able to contain the dye in the specified area during and after printing.
- It should not react with other components in the print paste.
- It should not break down during fixation process.
- It should be easy to remove after printing.
- It should be easily available and inexpensive.
- It should have a good shelf life.

You have studied about auxiliaries used in dyeing in Chapter 2. Let us now study the auxiliaries used in printing. Some of the commonly used auxiliaries in the print paste have been given in the table below:

Table 6.1: Components of the Print Paste

S. No	Name of Auxiliary	Function	Examples
1.	Thickening Agent	To provide a thick viscous base for transferring the dye to the fabric.	Natural-Starches and Gums Synthetic- Resins and Emulsions
2.	Dye/Pigment	To add colour to the print paste.	Direct, Acid, Reactive etc.
3.	Solvents	To help in dissolving the dye completely.	Glycerine, Lissapol, Glydote, Acetic Acid
4.	Wetting and Levelling Agents	To facilitate penetration and diffusion of dye in the fabric.	Turkey Red Oil(TRO), Lissapol, Acetic Acid
5.	Hygroscopic Substances	To absorb moisture from the atmosphere so that print paste does not dry up during printing and fixation.	Glycerine, Urea, Glydote
6.	Dyeing Assistants	To assist in fixation of certain dyes on fabric.	Sodium Chloride, Glaubers Salt, Acetic Acid
7.	Oxidising and Reducing Agents	To help in solubilizing and fixation of certain dyes on the fabric. E.g. Vat, Sulphur dyes.	Hydrogen Peroxide, Sodium Sulphite
8.	Anti - Foaming Agents	To prevent formation of bubbles or foam in print paste.	Turpentine Oil, Pine Oil, Silicone and Pyridine Compounds
9.	Catalysts	To quicken the fixation process of the dye on the fabric.	Di Ammonium Phosphate (DAP)

Know Your Progress 6.2

Q1) State whether the following statements are true or false:

i. Thickening agents are an essential component of all print pastes

ii. Hygroscopic Agents help to remove moisture from print paste

iii. Solvents are also known as levelling agents.

iv. Lissapol is an example of anti-foaming agent.

v. Catalysts are used to speed up fixation of the dye.

Q2) List two desirable properties of a thickening agent.

Q3) Explain the functions of a wetting agent.

Q4) Give two examples of solvents.'

Fill your score ______ / 16

6.3 METHODS OF PRINTING

After understanding the contents of the print paste, let us now learn how to print the fabric using the print paste. Printing can be done by many methods using different types of tools and equipment. We will now learn about two different methods of printing in the following sections.

Block printing is being carried out in some regions in India as a hereditary craft. Rajasthan Gujarat, Andhra Pradesh, Madhya Pradesh are some states specially famous for their block prints.

6.3.1 Block Printing

Block Printing is probably the oldest method of printing fabrics. It is a direct method of printing, where colour is directly applied on fabrics with blocks. It is done manually, hence it requires a lot of skill and is a slow process. Block prints are often characterised by slight irregularities in print.

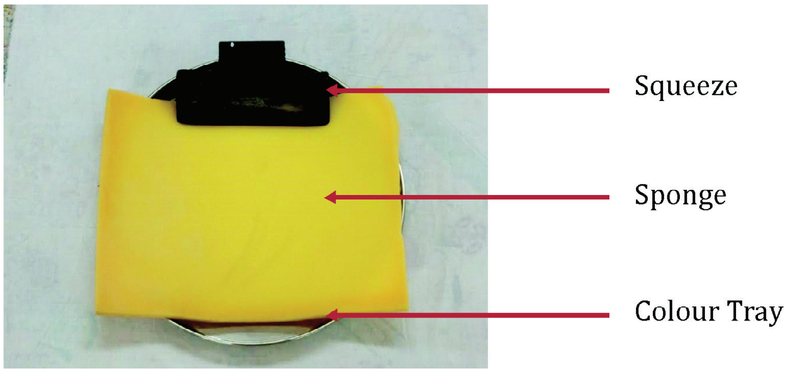
Have you seen any blocks used for printing? They are made from wood or metal, usually copper. The design to be printed is carved out of blocks with the design areas raised and the background areas carved out. Each block prints one colour. Hence, there will be as many blocks, as the number of colours in the design. For example, if a design has three colours, three blocks will be made i.e. one for each colour.

Figure 1: Blocks made from wood

Block printing caters to a small specialised segment of the market. Now, let us see how printing is done with blocks.

Printing Process

Block printing is a simple process. It does not require extensive equipment. The tools and equipment required are a padded printing table, a shallow pan or colour tray lined with a layer of absorbent material like sponge or jute, a squeegee i.e. a flexible rubber blade attached to a wooden handle and blocks.



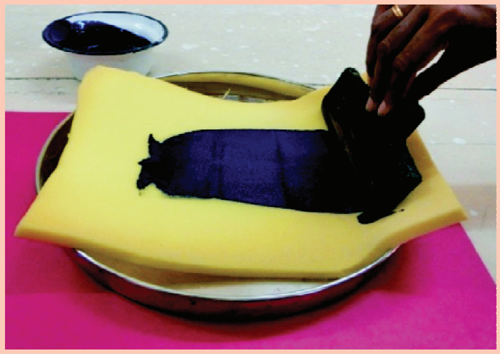
For obtaining a clear, sharp print a padded surface is essential. The padded surface facilitates uniform absorbtion of the print paste on the fabric. Therefore, the printing table is always padded with layers of blankets or jute. These layers are covered with a water proof protective covering, which is then covered with a layer of cotton fabric known as **back grey**. In addition, the printing table should be stable and strong.

The squeegee is used to spread the print paste uniformly in the colour tray.

BLOCK PRINTING IS CARRIED OUT IN THE FOLLOWING STEPS

The fabric to be printed is spread in open width and fixed firmly on a padded printing table.

The print paste is prepared and spread evenly in a shallow pan and colour tray with the help of a squeezee. The colour tray is lined with a layer of absorbent material to hold the print paste

The block charged with print paste is then pressed firmly onto the fabric surface with sufficient pressure to force the colour into the fabric.


The block charged with print paste is then pressed firmly onto the fabric surface with sufficient pressure to force the colour into the fabric.


The block is then lifted and the process is repeated as per the design.

The printed fabric is then dried.

Important!!

- Outlines of the design are printed first, followed by other colours in the design
- All the tools should be scrubbed and thoroughly washed in running water to remove all traces of the print paste after printing. They should be dried before storage.

Advantages

- Simple printing method, does not require expensive equipment.
- Prints have a greater decorative value and the stamp of craftsmanship.
- Provides flexibility in lay outing.

Disadvantages

- Manual process resulting in slow production.
- Requires considerable skill.
- Pattern alignment is difficult.

Portfolio Activity 6.2

1. Print a sample of cotton fabric with a block on a hard surface and another sample on a padded surface. Observe and compare the results in terms of clarity of print and ease of printing.
2. Find out and list at least three of the major block printing centers in India.

Know Your Progress 6.3

Match the following columns

	A		B
i)	Blocks	a)	Rubber Blade
ii)	Colour tray	b)	Hereditary craft
iii)	Squeegee	c)	Carved wood
iv)	Printing Table	d)	Print Paste
e)	Padded surface		

Fill your score ______ / 8

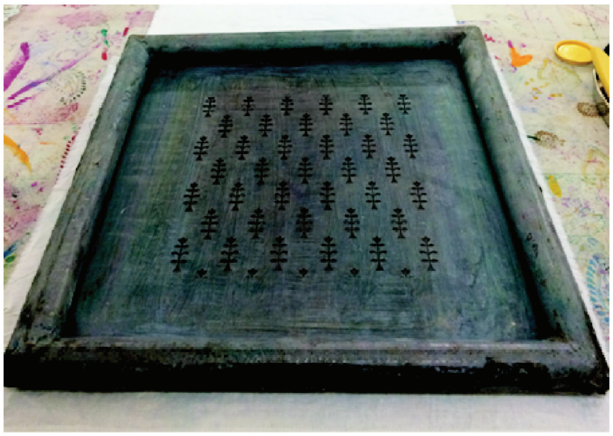
6.3.2 Screen Printing

Screen printing is a popular method of printing. It is a faster process as compared to block printing. As the name indicates, it is done by using screens.

Do You Know?

Screen printing has been developed from stencil printing!

Screens have a wooden or metallic frame.



A thin layer of nylon or other synthetic fabric is stretched tightly over the frame.The fabric is coated with an impenetrable film of chemicals with porous design areas. The porous areas allow the passage of print paste to the fabric whereas the impenetrable film blocks the passage of the print paste in the rest of the screen.

Do You Know?

Earlier silk fabric used for making screens hence the process was known as silk screen printing!

As in the case of blocks, each screen prints one colour. Hence, there will be as many screens as the number of colours in a design. As shown in the figure below, there are two types of screen printing:

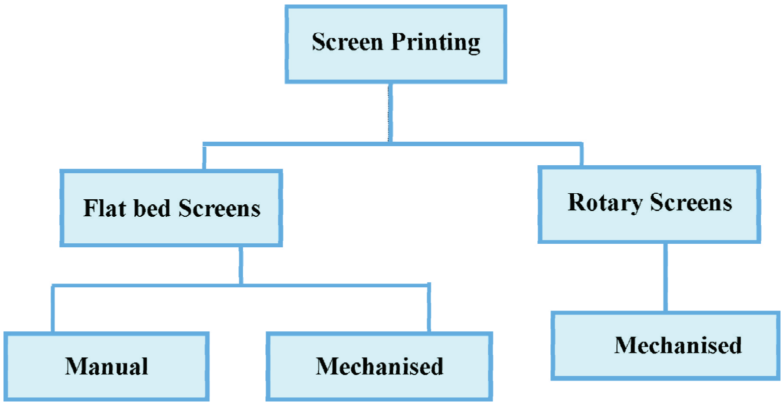


Figure 2: Types of Screen Printing

The screens for flatbed printing are rectangular or square, whereas the rotary screens are cylindrical in shape. The mechanised process of flatbed screen printing is still comparatively slow as compared to the automated and mechanised rotary screen printing method. Hence, faster production is possible with rotary screens.

Screen Printing is used for large designs on fabrics for apparel and home textiles. It is suitable for both yardages and completed end use products e.g. t-shirts, towels, bed spreads, sheets, curtains, etc.

Printing Process

Hand Screen Printing is done using flat-bed screens. It requires limited facilities and the equipment required is similar to block printing. So, the equipment needed includes a padded printing table, squeegee, container for print paste and screens.

The steps of screen printing are as follows:

The fabric to be printed is spread in open width and fixed firmly on a padded printing table.

The screen is laid in position on top of the fabric.

The print paste is poured at one end of the screen.

The print paste is moved across the screen to the other side with pressure using a squeegee. Thus, the print paste gets forced through only the porous design areas of the screen onto the fabric.

The screen is lifted and placed again in position according to the design and the process is repeated.

The printed fabric is dried.

Important

As in block printing, all the tools should be carefully cleaned and washed in running water after printing to remove remains of the print paste. They should be dried before storage.

Advantages

- Manual process requires simple facilities
- Flexibility in design layouting
- Faster production as compared to block printing; rotary screen printing method faster than flat- bed screen

Disadvantages

- Difficult to achieve fine line designs
- Clogging of screens may create problems
- Manual flat- bed screen printing method not recommended for large quantities

Know Your Progress 6.4

State whether the following statements are true or false:

i) The fabric used to make screens in earlier times was silk.

ii) Screen printing has led to the development of stencil printing.

iii) All screen printing methods are mechanised.

iv) Screen printing can be done on T-shirts.

v) Screen printing is faster than block printing.

Fill your score ______ / 10

Fixation of the Print

Have you seen a printed fabric which faded very soon? This is because the print had poor colourfastness as the dye had not been fixed onto the fabric. As we seen in the earlier, the printing processes deposit the dye/ pigment onto the surface of the fabric. However, in order to get printed fabrics with adequate colourfastness, it is essential to fix the dye on the fabric. This is achieved through after treatments of the printed fabric. These processes involve treating the printed fabric with chemicals, high temperatures, steam etc.

All printed fabrics require after treatments for fixation of the print

For carrying out these processes equipments like winches, jiggers, steamers, ovens etc. are used. You will recall that you have studied about them earlier in chapter three. These operations facilitate the fixation of dye on the fabric with the help of auxiliaries used in the print paste.

Before starting these aftertreatment processes, it is essential to dry the printed fabric to prevent smudging of the design. After fixation of the dye on the fabric, washing of the printed fabric is necessary to remove any unfixed dye, chemicals, thickening agents etc. from the fabric. This improves the fastness and texture of the printed fabric.

Porfolio Activity 6.3

Visit a printing unit in your neighbourhood and complete the following:

i) Observe and record the work being done there in terms of the products being made, the process, tools and equipments, dyes and chemicals being used.

ii) Observe and record the condition of the working areas in terms of cleanliness, lighting and ventilation. Suggest two improvements in their working environment.

iii) Interview two workers with respect to their working hours, wages and health.

6.4 THIS IS WHAT YOU HAVE LEARNT

TEXTILE PRINTING

Application of dye/pigments (colour) on fabric in the form of a repetitive pattern or design.

- It is also called Localised Dyeing.
- Small units of the design printed repeatedly to form the pattern are called Repeats
- Colourways are different colour combinations of the same design Chintz are cotton prints printed in 18^{th} century.

PRINT PASTE

Thickened medium for transfer of dye to the fabric. It contains auxiliaries like Thickening Agents, Solvents, Dye/Pigment, Wetting and Levelling Agents, Hygroscopic Substances, Dyeing Assistants, Oxidising and Reducing Agents, Anti Foaming Agents and Catalysts.

BLOCK PRINTING

- Direct method of printing
- Uses wooden and metal blocks
- Slow manual process
- Caters to small niche markets
- Simple process requiring skill
- Pattern alignment difficult

SCREEN PRINTING

- Popular method of printing
- Uses flat bed or rotary screens
- Faster than block printing
- Useful for printing large designs

FIXATION OF DYE IN PRINTS

- Fixation of dye is important as it results in improving colourfastness
- Fixation of dye is achieved through aftertreatments
- Drying and washing of the print are essential operations

6.5 LET US PRACTICE

Q1. Define the process of textile printing.

Q2. What are the factors that influence selection of auxiliaries in a print paste?

Q3. Explain the steps in the process of block printing.

Q4. Give two differences between block and screen printing.

Q5. Why are drying and washing of fabrics essential after printing of fabrics?

6.6 ANSWERS TO KNOW YOUR PROGRESS

Answer to Know Your Progress 6.1

i) localised

ii) paste

iii) repetitive

iv) inexpensive

v) chintz or chint

Answer to Know Your Progress 6.2

A1. i) True

ii) False

iii) False

iv) False

v) True

A2. Properties of a good thickening agent are :

- It should be able to contain the dye in the specified area during and after printing.
- It should not react with other components in the print paste.
- It should not break down during fixation process.
- It should be easy to remove after printing.
- It should be easily available and inexpensive.
- It should have a good shelf life.

Any two of the above.

A3. Wetting agents help the dye to penetrate the fabric. They also help dye molecules to diffuse evenly in the fabric.

A4. Examples of solvents are : Glycerine, Lissapol, Glydote or Acetic Acid.

Any 2 of the above.

Answer to Know Your Progress 6.3

i. c

ii. d

iii. a

iv. e

Answer to Know Your Progress 6.4

A1. i) True

ii) False

iii) False

iv) True

v) True

Fill your score _______ / 46

PRACTICAL WORK

Practical 6.1

Preparation of Print Paste

Objective: To prepare the print paste for printing of fabric with pigment colours.

Materials Required: SLN Binder, Urea, Di-ammonium Phosphate, Kerosene oil, Water, Pigment Colours, Acrofix, High Speed Stirrer, Container or vessel

Procedure: The main component of the print paste is the emulsion binder which functions as the thickening agent. Pigment colours are added to the emulsion binder for making the print paste. Therefore, there are two steps for making the print paste as follows:

1. Preparation of emulsion binder:

Constituents:

SLN Binder	120ml
Urea	25gm
Di-ammonium Phosphate	25gm
Water	100ml
Kerosene	730ml
	1000 parts

Method:

- Mix SLN Binder and water and stir.
- Add Urea and Di-ammonium Phosphate to the above and mix well.
- Place the above mixture in the container and start stirring the above mixture with a high speed stirrer.
- Add Kerosene Oil in small quantities at regular intervals while mixing the above mixture with the high speed stirrer.
- Continue till all the Kerosene oil has been added and the mixture has become a uniform thick white paste.

2. Preparation of print paste:

Constituents:

Acramin Pigment	2-6 parts
Emulsion binder (thickener)	x parts to make 100
Acrofix	2 drops

Method:

- Take the required quantity of the emulsion binder.
- Add the required amount of pigment and mix well.
- Add acrofix and mix thoroughly.
- The print paste is ready for use in printing.

Precautions:

1. Add small quantities of kerosene oil slowly during preparation of emulsion binder.
2. Ensure that the earlier instalment of kerosene oil has been mixed completely before adding the next instalment.
3. Quantity of urea may be reduced if humidity is high.
4. Add acrofix just before printing.

Practical 6.2

Block Printing in Single Colour

Objective: To print cotton fabric with pigment colours by block printing method.

Materials Required: Blocks, Colour tray, Sponge (or jute), Squeegee, Enamel bowl, spoon(or glass rod), padded printing table, common pins, white cotton fabric, emulsion binder, acramin pigment colours.

Pre-preparation:

1. Prepare the white cotton fabric for printing by washing it with mild soap and water (or soaking overnight in water) to remove the stiffening agents and finishes from the fabric surface. Iron the fabric and cut the fabric into required size for printing.
2. Prepare the emulsion binder or thickening agent for printing with pigment colours.

Procedure:

1. Fix the cotton fabric firmly on the printing table with the help of common pins.
2. Prepare the print paste by taking the required quantity of emulsion binder in an enamel bowl and adding the pigment colour to it (Amount of pigment will depend on the depth of shade required). Mix it well with a spoon or glass rod to obtain a uniformly coloured print paste.
3. Place the sponge on the colour tray. Prepare the colour tray by spreading the print paste on the sponge uniformly with the help of squeegee.
4. Tap the block gently on the colour tray to charge the block with the print paste.
5. Press the block firmly on the fabric according to the design.
6. Lift the block and charge it with print paste again and repeat.
7. Dry the printed fabric in open width in sunlight.
8. Iron the fabric from the wrong side to fix the pigment colours on the fabric.

Precautions:

1. Fix the fabric firmly on the table so that it does not move during printing.
2. Ensure that the print paste is smooth, without lumps and in the correct viscosity.
3. Press the block gently on the colour tray so that only the raised design areas of the block are charged with print paste.
4. Lift the block vertically from the fabric to avoid smudging of print.
5. Mark the pattern on the fabric before starting printing.
6. The fabric should be white or in a light pastel shade.

Practical 6.3

Block Printing with Multiple Colours

Objective: To print cotton fabric by block printing method in 2-3 pigment colours.

Materials Required: Same as in practical 2.

Pre- Preparation: Same as in practical 2.

Procedure: If a design has 2-3 colours, there will be as many blocks for the printing the design. For eg, a 3 colour motif/design will have 3 blocks to print it viz., 1 for the outline and 2 for filling in the 2nd and 3rd colours. Printing will be carried out as follows:

1. Fix the cotton fabric firmly on the printing table with the help of common pins.
2. Prepare the print paste by taking the required quantity of emulsion binder in an enamel bowl and adding the pigment colour to it (Amount of pigment will depend on the depth of shade required). Mix it well with a spoon or glass rod to obtain a uniformly coloured print paste.
3. Place the sponge on the colour tray. Prepare the colour tray by spreading the print paste on the sponge uniformly with the help of squeegee.
4. Similarly, prepare print paste and colour tray for 2nd /3rd colour also.
5. Select the block for the outline of the design and charge the block with print paste in 1st colour and print as described in practical 2. Repeat according to the pattern.
6. Take the block for filling in 2nd colour, charge the block with print paste in 2nd colour. Carefully place the block within the printed outline, matching the pattern to fill in 2nd colour. Repeat according to the pattern.
7. Similarly, print with the block for 3rd colour, if any, within the printed outline of the design. Repeat according to the pattern.
8. Dry the printed fabric in open width in sunlight.
9. Iron the fabric from the wrong side to fix the pigment colours on the fabric.

Precautions:

1. Usually, outline of the design should be in a darker colour as compared to colours used for filling.
2. Start printing with outline before printing the other colours.
3. If a block has been used to print one colour, wash and dry it before using it in next colour.
4. Blocks for filling should be printed with precision within the outline to obtain correct register of the print without any faults.

Practical 6.4

Screen Printing

Objective: To print cotton fabric with pigment colours by screen printing method.

Materials Required: Screens, Squeegee, Enamel bowl, spoon (or glass rod), padded printing table, common pins, white cotton fabric, emulsion binder, acramin pigment colours.

Pre- Preparation: Same as in practical 2.

Procedure:

1. Fix the cotton fabric firmly on the printing table with the help of common pins.
2. Prepare the print paste by taking the required quantity of emulsion binder in an enamel bowl and adding the pigment colour to it (Amount of pigment will depend on the depth of shade required). Mix it well with a spoon or glass rod to obtain a uniformly coloured print paste.
3. Place the screen in position on the fabric.
4. Pour the print paste from the enamel bowl along one side of the screen.
5. Move the print paste to the opposite side of the screen with the help of a squeegee, pressing firmly.
6. Lift the screen and place it again on the fabric according to the design. Repeat the process.
7. Dry the printed fabric in open width in sunlight.
8. Iron the fabric from the wrong side to fix the pigment colours on the fabric.

Precautions:

1. The print paste should have correct flowing viscosity i.e. it should neither be too thick nor too thin.
2. Do not pour excess print paste onto the screen as it will result in smudging of the print.
3. Take care to cover the entire design while moving the print paste across the screen.
4. The fabric should be white or in a light pastel colour.

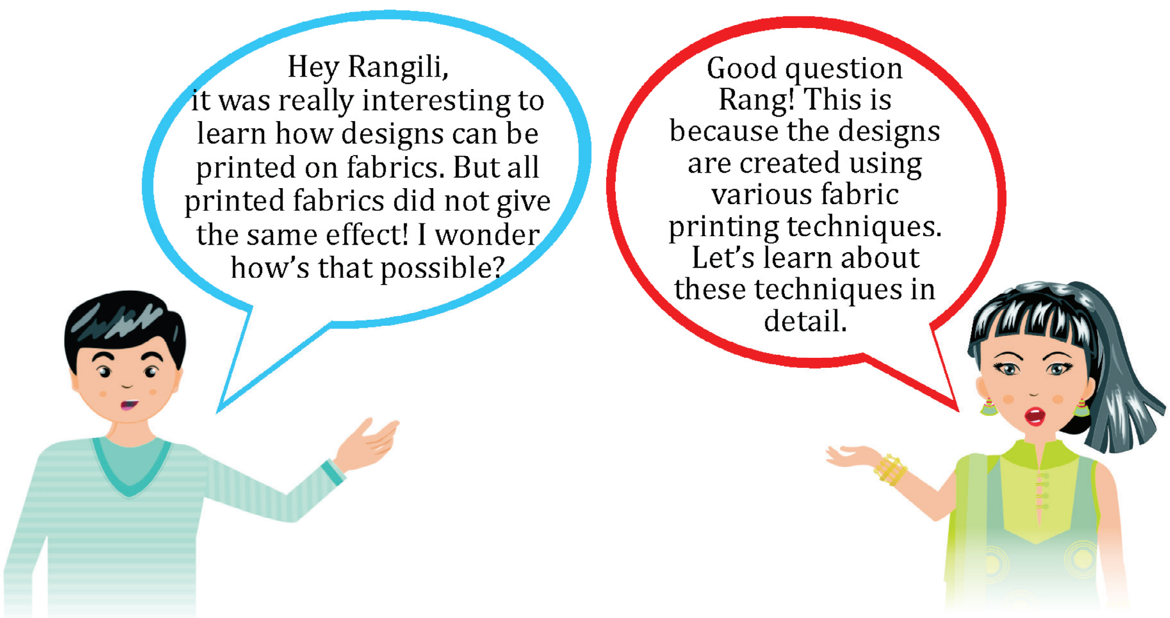
7. Designing Fabrics through Printing

KEYWORDS

- Direct printing
- Discharge printing
- Resist printing
- Transfer printing
- Digital printing
- Discharging agents
- Resisting agents
- Dye fixation

OBJECTIVES

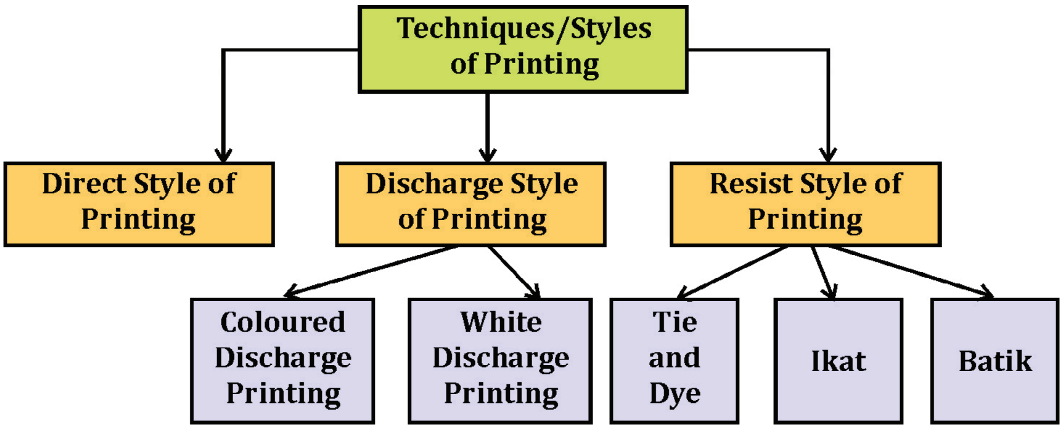
- Explain the techniques of printing Direct/Discharge/Resist
- Differentiate between direct, discharge and resist style of printing
- State latest developments in printing
- Apply the various styles of printing on fabrics - Direct/Discharge/Resist



We have learnt that Printing is a method of depositing colour onto fabrics and is often defined as localised dyeing. We have also learnt about the various methods of printing in the previous chapter. In this chapter we shall learn about the basics of several fabric printing techniques.

7.1 TECHNIQUES OF PRINTING

Techniques of printing are commonly referred to as styles of printing. Various styles of printing can be carried out using different printing methods. The most commonly used styles of printing that are in use today are:



7.1.1 Direct Printing

As the name suggests, in this style, the dye is directly applied onto the fabric, which is either white or coloured. It is one of the most common and the most extensively used style for mass-produced printed fabrics. The desired pattern is produced by imprinting the dye onto the fabric in a paste form using any of the printing methods - block printing (Fig. 7.1) and screen-printing that you have already learnt in chapter 6.

In India the block printing of Rajasthan that has been done since ancient times is an example of direct style of printing. It is the simplest and probably the oldest style of printing. The characteristic feature of direct style printing is that usually darker coloured prints emerge on lighter ground.

Fig 7.1:
Direct printing on fabric

Advantages

- Least expensive
- Suitable for printing of both simple and complicated designs
- Can be applied on all class of fibres

Disadvantages

- Design limitations
- Labour intensive process
- Small repeats

You must have seen people using stamp pad in their offices for putting stamps on paper. The stamp picks up the ink of the inkpad and is imprinted onto the paper. Direct style of printing works exactly on the same principle!

Important points to remember!

- Printed fabrics are thoroughly dried and washed after printing
- In case of printing with dyes, drying and steaming is carried out so that localised dyeing can occur.
- Pigment printed fabrics are only cured by ironing from wrong side, no additional treatment required.

7.1.2 Discharge Printing

In this style of printing, patterns are achieved by removing or discharging the colour from the surface. The colour is discharged with a chemical compound known as 'discharging agent'. Thus, the prints achieved are often lighter in colour than the background.

Through this style of printing, two types of colour effects can be achieved: white and coloured.

In 'white' discharge printing, a dyed fabric is printed with a chemical (discharging agent), which removes the colour from design areas.

In 'coloured' discharge printing a dye is added to the print paste containing the discharging agent. On application, the discharging agent of the print paste discharges the ground colour in the printed area where the dye deposits and fixes itself thereby producing a coloured discharge effect.

Some of the commonly used discharging agents are: Rongalite-C, Potassium Chlorate, and Stannous Chloride.

Advantages	Disadvantages
♦ Unique style of printing ♦ Large areas of ground colour possible ♦ Complex patterns are possible on dark background ♦ The effects produced are very striking and have excellent clarity	♦ Higher production costs ♦ Discharging agents may affect the strength of the fabric – can make it weak ♦ Limited to patterns with few colours ♦ Not suitable for all dye classes

Try This!

Take a small piece of white paper and colour it with any coloured pen. Now take the eraser pen and use it on the paper that you have just coloured to etch out the colour in those areas. What do you observe?

This is how 'white' discharge effect is obtained.

7.1.3 Resist Printing

In this style of printing, the fabric is first printed with a resisting agent that blocks the penetration of dye into the fabric wherever the resisting agent has been applied. The fabric is then dyed. The dye gets absorbed only in those parts that are not covered by the resist paste. After dyeing, the resist paste is removed leaving a white or light coloured pattern on a dark background. The effect produced is similar to discharge printing.

Different types of resisting agents can be used depending upon the type of effect desired. The resisting agents can function either mechanically or chemically or sometimes, in both ways.

Examples of mechanical resisting agents include waxes, fats, resins, thickeners and pigments, such as china clay, the oxides of zinc and titanium, and sulphates of lead and barium.

Chemical-resisting agents include a wide variety of chemical compounds, such as acids, alkalis, various salts, and oxidising and reducing agents.

Advantages

- High colour fastness standards
- Dyes of great chemical stability, which could not be discharged, can be resisted to give prints

Disadvantages

- It is an expensive style of printing
- Labor intensive process

Try This!

Take some water in a pan and add blue ink to it. Now take a small piece of white cloth and tie some coins using a thread. Make sure that the tying is done tightly. Dip the tied cloth in coloured water that you have just prepared and take it out after 1-2 minutes. What do you observe?

The entire white fabric will turn blue except those areas, which were tied with the thread. This way many interesting patterns can be formed!

7.1.4 Difference between Direct, Discharge and Resist Style of Printing

S. No.		Direct Printing	Discharge Printing	Resist Printing
1	Definition	Dye is directly applied onto the fabric, which is either white or coloured.	A dyed fabric is printed with a chemical (discharging agent), which selectively destroys the dye in design areas.	The fabric is first printed with a resisting agent, then dyed.
2	Application	Can be applied on all fibres	Cannot be applied on all fibres	Cannot be applied on all fibres
3	Imprint	Clearly defined pattern outlines	Striking and excellent clarity in prints achieved	Pattern outlines are not sharp
4	Design effect	Usually darker coloured prints emerge on lighter ground	Complex patterns are possible on dark background	Both light and dark colour patterns are possible
5	Fabric strength	Dyestuffs used do not affect the strength of the fabric	Discharging agents may weaken the fabric	Resisting agents do not affect the strength of the fabric
6	Design intricacy	Suitable for printing of both simple and complicated designs	Simple patterns can be done easily however intricate patterns are possible on dark background	Intricate patterns are not possible

In this section you have learnt that:

- Direct printing is the simplest and most extensively used style of printing wherein the dye is directly applied onto the fabric, which is either white or colored
- Discharge printing makes use of discharging agents to produce 'white' or 'colored' discharge effect
- Resist printing makes use of resisting agents that blocks the penetration of dye into the fabric wherever the resisting agent has been applied.

Portfolio Activity 7.1

Find samples of fabrics made using various styles of printing techniques you have studied so far. You can look for samples in your house, in a near by fabric shop, books, and magazines which represent different printing techniques. Paste them neatly in your portfolio book with labels under each picture.

Know Your Progress 7.1

1. **Fill in the blanks with the correct word**
   a. An example of .... printing style is the block printing of Rajasthan.
   b. In colored discharge printing a .... is added to the print paste containing the discharging agent.
   c. Acids and alkali can be used as .... resisting agents.
2. **Write the correct words from the given options in Column B against the words given in Column A.**

Rongalite-C   Direct printing   Resist printing   Resins

Column A	Column B
a. No sharp definition of pattern	
b. Discharging agent	
c. Mechanical resisting agent	
d. Simplest style of printing	

Fill your score ______ / 14

7.2 VARIATIONS OF RESIST STYLE OF PRINTING

So far you have learnt about the various styles of printing fabrics. Now let us also learn about some interesting variations of the resist style of printing. As mentioned above, different types of resisting agents can be used depending upon the type of effect desired. Also resist style of printing can be done at yarn stage or fabric stage. Depending upon whether the material to be dyed is a yarn or a fabric, resist printing can be done in various ways of which the most common ones are:

1. Tie and Dye
2. Batik
3. Ikat

7.2.1 Tie and dye

In this style, the dye is resisted by tying the fabric or finished garment with a thread using various tying techniques (discussed in the practical section later in the chapter) before it is put into the dye bath. The untied portions take up the colour but the dye does not penetrate the tied areas (Fig. 7.2).

Fig 7.2: Tie-dye fabric

This style produces variety of patterns and no machine cost is involved in the process. The process of tying is however labourious and time taking and demands skilled labor.

Bandhini - The Traditional Art Form of India

The history of dyeing dates back to pre historic times. According to historical evidences, the first bandhini sari was worn at the time of Bana Bhatt's Harshcharitra in royal wedding. It was believed that wearing of Bandhini sari can bring good fortune to a bride.

The term 'Bandhini' is derived from the word 'Bandhan' that means tying up. It is an ancient craft that is mainly practised in state of Rajasthan and Gujarat. The local communities produce odhanis, sarees and turbans for their personal use and for selling.

7.2.2 Batik

Batik printing originated in the island of Java. This style of printing involves the use of wax as a resist on the fabric by covering a part of it and then dyeing the cloth. It is a threestage process of waxing, dyeing and dewaxing (removing the wax). The areas where wax is applied do not take up the dye and when the wax is removed the contrast between the dyed and undyed areas gives the pattern. The characteristic effect of batik are the fine lines running irregularly across the fabric (Fig. 7.3).

Fig 7.3: Batik fabric
Source: commons.wikimedia.org

Batik is a very simple technique and can be done by anyone. It is a very laborious and time taking process though. Many batik patterns are used in a wide variety of fabrics. However there are certain limitations of this technique. The dyeing is usually done using azoic dyes but due to the harmful effects of these dyes on environment, their usage has been restricted. Now-a- days, cold reactive dyes are being used for the purpose.

Batik - The Traditional Fabric of Indonesia

Batik is historically the most expressive and subtle of the resist methods. A tradition of making batik is found in various countries, including Indonesia, Singapore, Malaysia, India, Bangladesh, Sri Lanka, and Nigeria; the batik of Indonesia, however, is the bestknown.

The word batik originates from the Javanese *tik* and means to dot. In Java, certain patterns are reserved for royalty, while other are worn on specific occasions.

7.2.3 Ikat

It is defined as a method of producing woven fabric by using tie-dyed warp yarns or weft yarns or both. The effects are very beautiful and resemble prints though design is achieved after weaving. In Ikat, the resist is formed by binding individual yarns or bundles of yarns with a tight wrapping (usually rubber) applied in the desired pattern. The yarns are then dyed (Fig. 7.4). The bindings may then be altered to create a new pattern and the yarns dyed again with another colour. This process may be repeated multiple times to produce elaborate, multicoloured patterns. When the dyeing is finished all the bindings are removed and the yarns are woven into cloth. Ikats are mainly produced in Gujarat, Andhra Pradesh and Odisha.

Fig 7.4: Ikat fabric

Ikat fabrics have a distinct style and unparalleled beauty. Making of an ikat requires highly skilled labor. The process is very time consuming and laborious, hence they are expensive.

Ikat - The Handwoven Fabric using Tie-dyed Yarns

Ikat is produced in many traditional textile centres around the world, from India to Central Asia, Southeast Asia, Japan, Africa and Latin America.

Double ikats are relatively rare because of the intensive skilled labour required to produce them. Patan Patola, is one of the rarest forms of double Ikat, which takes a lot of time and effort in dyeing and weaving. A different form of Patola ikat is made in Rajkot, Gujarat. Telia Rumal made in Andhra, Pasapalli from Odisha and Puttapaka from Telangana are other Indian Ikats.

Do you know that mud can also be used as a resist? It's a unique style of resist printing that is practiced in Rajasthan since a long time and is called Dabu printing. You can find out more about this and discuss with your friends.

In this section you have learnt that:

- The most common variations of resist style of printing are tie and dye, batik and ikat
- In tie and dye technique, the dye is resisted by tying the fabric using a thread as a resisting agent
- In batik, wax is used as a resisting agent and after the fabric is dyed, fine lines appear running irregularly across the fabric.
- In ikat, tying is done at the yarn stage and the fabric is then woven

Portfolio Activity 7.2

Make a visit to the market and look around for products that are made using tie dye, batik and ikat resist techniques. Also compare their prices. Now prepare a list of all products that you have seen and try to answer the questions given below:

1. Which variation of resist printing is more appealing to you? Give reasons for your answer.
2. What all new products can be developed using the technique that you like?
3. Which of the three techniques is more expensive? Give reasons

Know Your Progress 7.2

1. Name the variation of resist style printing that is employed for yarns to create a specific pattern after weaving?
2. List any four types of resist dyeing techniques?
3. Tabulate any two advantages and disadvantages of Tie and dye.

Fill your score ______ / 6

7.3 LATEST DEVELOPMENTS IN PRINTING

With the advancement in technology, many new techniques have developed for fabric printing in order to impart designs in an interesting and faster way. Some of the popular ones are:

- Digital Printing
- Transfer Printing
- Polychromatic Printing

7.3.1 Digital Printing

This technology uses large format digital inkjet printers, which have been developed to print on various materials like paper, canvas, fabric etc. (Fig. 7.5). Each fibre type demands a specific printing ink. The fabric to be printed is fed through the printer using rollers and the printing ink is applied onto the fabric in form of several tiny droplets. After printing the fabric it is steamed in order to fix the colour. The design to be printed can be developed using any design software like Photoshop or any design or photograph can be digitally scanned and printed on the fabric.

Fig 7.5: Digital printed fabric
Source: commons.wikimedia.org

This high precision printing technique has opened up endless opportunities for customisation and allows the user to print as little as possible at a much faster processing speed. Rejection level of printed fabric is much higher though and the cost of printing for bigger production runs is much more as compared to other forms of printing.

7.3.2 Heat Transfer Printing/Transfer Printing

Heat transfer printing is an indirect method of printing in which designs are transferred from specially printed paper to a thermoplastic fabric under controlled conditions of temperature, time and pressure, which fixes the print onto fabric (Fig. 7.6). No after treatment of fabric is required.

This is a simple process to produce excellent quality prints and is applicable to synthetic fabrics like polyester. The colour range, however, is limited and the technique is not economical for small orders.

Fig 7.6: Transfer printing on fabric

7.3.3 Polychromatic printing

Polychromatic printing is a combination of painting and screen printing. With this process, all the colours in an image are painted on a single print screen, and then printed on fabric or paper with one pull of the squeegee (Fig. 7.7).

It is an excellent technique for anyone interested in obtaining multiples from one painted image on paper or fabric. It requires excellent drawing and painting skills.

Fig 7.7: Polychromatic printing on fabric

Besides the above mentioned developments in printing technology, you can also try to find out about photo printing, electrostatic printing and blotch printing. It would be interesting!

In this section you have learnt that:

- Many new techniques have developed for fabric printing in order to impart designs in an interesting and faster way
- Digital printing allows user to print as little as possible
- Heat transfer printing is an indirect method of printing applicable to synthetic fabrics like polyester

Portfolio Activity 7.3

Suppose you want to set up a textile-printing unit but you are confused which printing machines to buy. How will your knowledge about the various printing techniques help you to take the right decision?

Know Your Progress 7.3

1. **Give one-word answers to the following questions**

   a. Which technology of printing allows the user to print small samples?

   b. Which printing technique is a combination of painting and screen printing?

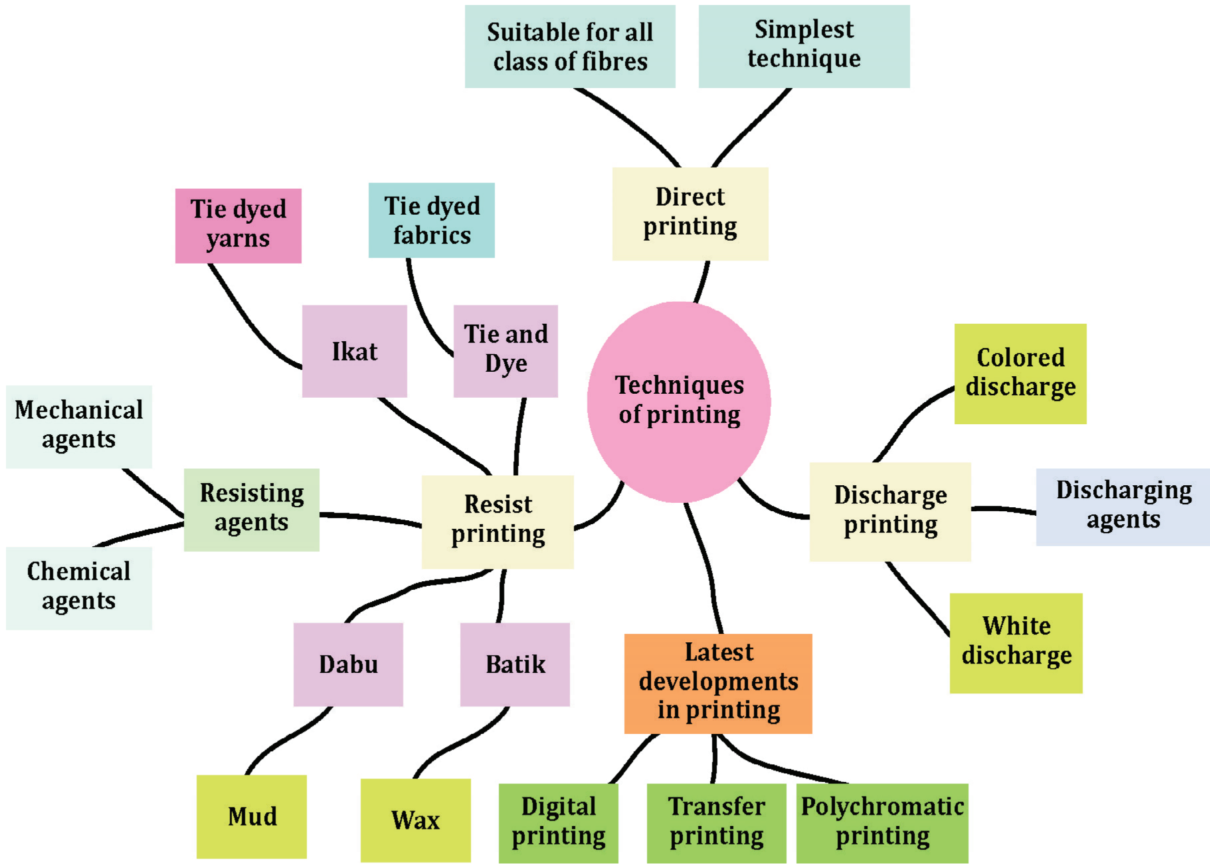
2. **State whether the following statements are true or false. (Tick the correct option)**

   a. Transfer printing provides endless opportunities for customization. True/False

   b. In digital printing, colour range is limited. True/False

Fill your score ______ / 8

7.4 THIS IS WHAT YOU HAVE LEARNT



Portfolio Activity 7.4

Imaging you were chosen to be a student of textile craft academy where u can learn the various textile printing techniques. As these skills represent the rich textile heritage of our country would you like to take this up as a profession in your life? Give reasons for your answer.

7.5 LET US PRACTICE

1. Write short notes (in about 40-50 words) on:
   a. Direct printing
   b. Tie and Dye
2. Indicate any two advantages and disadvantages of resist printing.
3. Differentiate between Discharge and resist styles of printing.
4. Explain the process of making of an ikat fabric.

7.6 ANSWERS TO KNOW YOUR PROGRESS

Answer to Know Your Progress 7.1

1. a. Direct
   b. Dye
   c. Chemical

2. a. Resist printing
   b. Rongalite-C
   c. Resins
   d. Direct printing

Answer to Know Your Progress 7.2

1. Ikat

2. Tie and Dye, Ikat, Dabu and Batik

3. **Advantages:**

   a. Produces variety of patterns
   b. No machine cost involved

   Disadvantages:

   a. Labourious
   b. Time taking
   c. Skilled labour required

Answer to Know Your Progress 7.3

1. a. Digital printing
   b. Polychromatic printing

2. a. False
   b. False

PRACTICAL WORK

Objectives

After going through the lesson the learner should be able to:

- Perform the techniques of tie and dye and batik
- Carry out pigment printing and discharge printing

Practical 7.1

Aim: To tie and dye cotton fabric “

Material Required: Desized cotton fabric (10”x10”), cotton yarn for tying, beads of different shapes and sizes, clips, pins, needle, thread, pencil, any other material for variation in tying, Sodium-bi-carbonate, sodium chloride, direct dyes, fixing agent.

Procedure:

I - PREPARATION OF FABRIC

The process of desizing is important for the proper penetration of the dye into the fabric and its uptake. Desize the material as you have learnt in the chapter 4. The desized material should be soft and supple to touch.

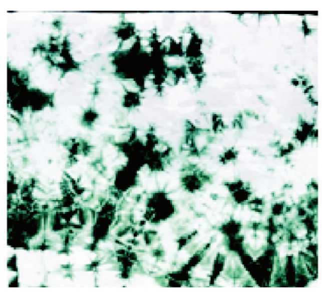
II - TYING

Use various tying techniques before dying the samples

a. Marbling

The variegated and irregular cloud like texture which is dyed on cloth is called as marbling. The cloth is bunched up closely and bound with thread or string, before being dyed. Marbling provides a rich and an unusual background for prints, embroidery etc.

Marbling

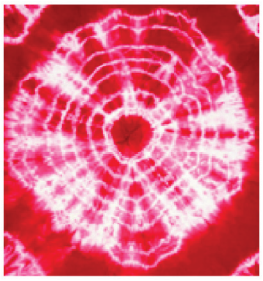


Final effect

b. Twisting and coiling

This texture is more evenly spaced over the cloth. The whole length of the cloth must be immersed in the dye. In this method, the cloth is first twisted to the extent that it starts coiling itself, and then it is tied strongly with a thread.

Twisting & Coiling



Final effect

c. Knotting

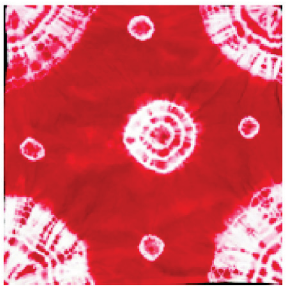
In this method the length of the cloth is tied in knots. It may be operated in three ways:

(i) Length of cloth tied in knots

(ii) A square, a rectangle, a triangle of cloth knotted

(iii) Knots tied in length of cloth to form an overall pattern

Knotting

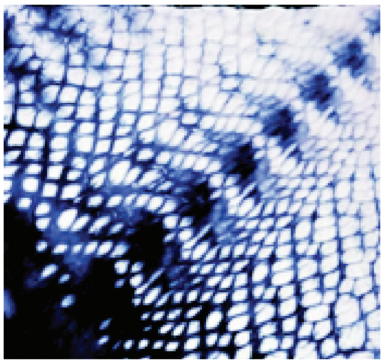


Final effect

d. Rouching

In this technique the fabric is gathered up around a cord or a stick. The fabric hidden in the gathers does not receive the colour. The part of the fabric on the outer side gets dyed to give a patterned effect.

Rouching



Final effect

e. Binding

In this technique, certain parts are tied with threads, before being dyed so that they resist the dye partially or completely. Binding applied before first dyeing receives the original colour and binding applied before the second dyeing receives the first colour and so on.

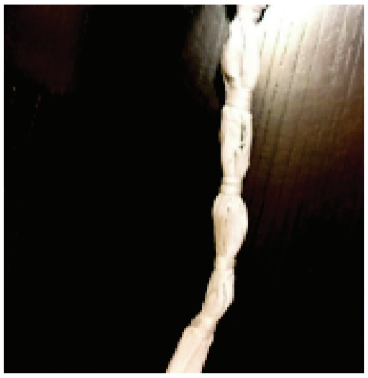
Types of binding

(i) Plain binding: A band of very close solid binding in a single or double layer is done. It gives a complete resist if tied tightly.

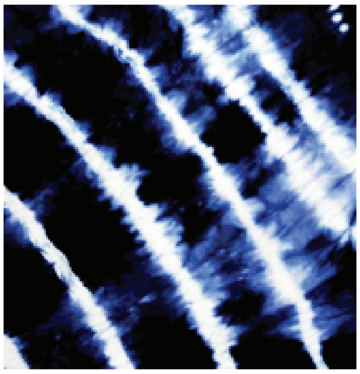
(ii) Circular binding: Pick up a point of cloth at centre, smoothen and close it like an umbrella. Then bind the threads from the central point to extreme edge of the fabric.

(iii) Pin/spot binding: A very thin tiny spot is lifted by a pin and tied up. A fine thread should be used for binding.

(iv) Clump binding: This method involves, the tying of bunches or clumps of material. The cloth itself is bunched or arranged, in various ways. Small objects like beads and pebbles are tied on the fabric.

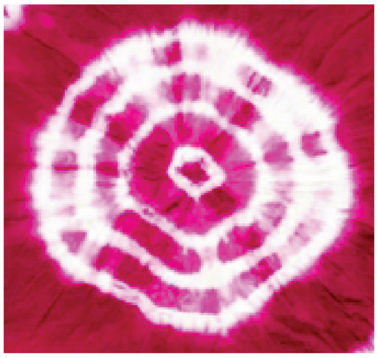


Plain Binding

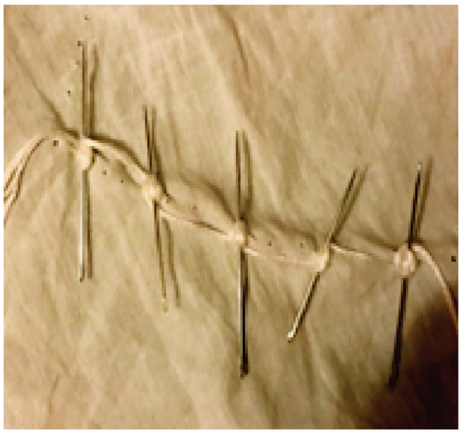


Final effect

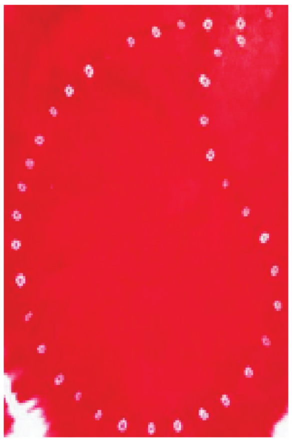
Circular Binding



Final effect

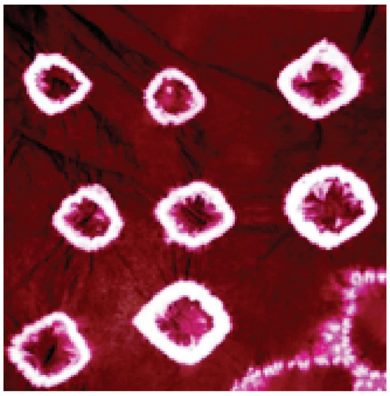


Pin Binding



Final effect

Clump Binding

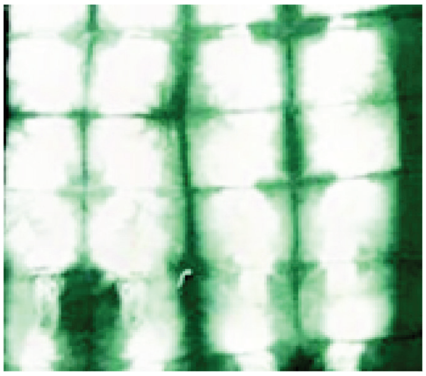


Final effect

f. Folding

Many striking patterns and effects, especially stripes, are produced by folding technique combined with binding. It requires accurate workmanship and patterns like simple stripes in rows and triangles and squares can be created.

Folding



Final effect

g. Tritik

In this method, stitching is done along a design pattern and the tread is pulled so as to draw the fabric together in such a way that it resists dye penetration in specified areas. It is essential to have a very strong thread.

Tritik

Final effect

II - DYEING

Dye the tied fabric with direct dyes as described in chapter 5. Start with the lightest colour. After dyeing the first colour, tie the areas wherever you want to reserve the first colour. Dye in the second colour and so on. " Paste all the prepared samples in the Portfolio.

Practical 7.2

Aim: To prepare samples with various techniques of batik on cotton fabric using cold reactive dyes.

Material Required: Brushes of various widths and sizes, wax, Cotton fabric sample (10”x10”), embroidery frame, dyes, soap, heater/gas stove

Procedure

I - PREPARATION OF FABRIC

The cloth has to be made completely free from size and grease. So desize it properly (as learnt in chapter 4) to get a smooth surface on which the design can be drawn easily. The fabric is then stretched on a frame for ease in application of wax.

CAUTION

Batik should be done under supervision of an expert!

II - APPLICATION OF WAX

Two main types of waxes are used - paraffin wax (light coloured and can be easily removed) and bees wax (dark coloured and more adhesive). To get various types of cracks both paraffin and bees wax can be taken in required proportions: “

- 100% paraffin wax for more cracks
- 50% paraffin and 50% bees wax for moderate cracks
- 100% bees wax for little or no cracks

Bees Wax

Paraffin Wax

Design to be done in batik

Wax is melted in a small container and applied onto the material with brush in a predetermined pattern. Wax is applied both on the face and back of the fabric. Before application of wax on the fabric, the hot wax should be tested on a rough piece of cloth to see if it is hot enough for use. If the wax spreads on the cloth, then it is ready to use. Also the wax should reach both sides of the material. The layer of the wax should not be very thin; it should be thicker to ensure pure colours. Wax can be applied onto the fabric with any of the following techniques:

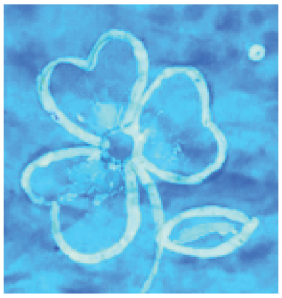
- Painting i.e. covering/painting the design area with wax
- Outlining i.e. only painting the outline of the design /motif with wax
- Dry brushing i.e. during application, the brush should be free of excess wax. Before

applying brush to the cloth, squeeze out the extra wax on a piece of newspaper or rough piece of cloth.

- Scratching i.e. cover the entire fabric with wax. Scratch out the wax along the contours of the design with the back of a pin, brush etc.
- Application of wax with a stencil

Dry brushing

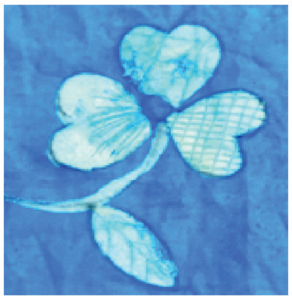
Outlining



Final effect - Outlining and Dry brushing

Painting

Scratching



Final effect

III - DYEING OF THE FABRIC

After application of wax, the fabric is dyed using cold reactive dyes (recipe given in chapter 5) in the lightest colour. All dyeing for batik must be done in cold dye bath, as any heat for fixing the dye would melt the waxed design and render it useless.

During the dyeing process all waxed areas repel the dyestuff and only the untreated areas absorb colour. Also, care should be taken not to squeeze the waxed material as the wax may crack and the dye may penetrate into the fabric excessively to give a patchy effect. After dyeing, the fabric is rinsed in cold running water and dried.

IV - REWAXING AND REDYEING

After drying, wax is again applied onto the fabric in preparation for the second colour. It covers previously dyed areas and other areas not to be coloured by the second dye. The fabric is then dyed in the next colour. This process of waxing and dyeing is repeated for as many additional colours as are required to complete the pattern.

V - DEWAXING

After completion of waxing and dyeing, wax is removed from the cloth. A part of the wax layer is carefully peeled off with a blunt knife. The fabric is then boiled in mild soapy water with continuous stirring. As the water cools, wax solidifies and floats on the surface of water. If wax is still not completely removed the process is repeated with fresh water and soap.

“Paste all the prepared samples in the Portfolio.

Practical 7.3

Aim: To carry out white discharge printing on cotton fabric “

Material Required: Cotton fabric sample to be printed (10”x10”), all ingredients as per the dyeing recipe, soap, water, heat source “

Procedure:

WHITE DISCHARGE ON AZOIC GROUND	
Rongalite c	25 parts
Titanium dioxide	10 parts
Solution salt B	8 parts
Potassium carbonate	60 parts
Anthraquinone paste	20 parts
Gum tragacanth x parts	24
Total	**100 parts**

- Fabric is naptholated and then coupled with different fast salts. It is then padded with a solution of 10 gel resist salt and dried.
- Azoic dyed fabric is then printed with white discharge paste
- The fabric is dried and steamed for 45 minutes at 100-1020C
- Fabric is immediately treated with 1.5 gel sodium bi carbonate solution at boil for five minutes to remove decomposition colours of the azoic colours.

Practical 7.4

Aim: To carry out coloured discharge printing on cotton fabric “

Material Required: Cotton fabric sample to be printed (10”x10”), all ingredients as per the dyeing recipe, soap, water, heat source “

Procedure:

COLOURED DISCHARGE WITH VAT DYE ON AZOIC GROUND	
Vat dye paste	4 parts
Glycerine	10 parts
Potassium carbonate	12 parts
Rongalite C	25 parts
Anthraquinone paste 30%	4 parts
Starch tragacanth	x parts “
Total	**100 parts**

- Fabric is naptholated and then coupled with different fast salts.
- Azoic dyed fabric is then printed with coloured discharge paste
- The fabric is then dried and steamed for 30 minutes at 100-1020C. Rinse the sample
- The sample is then air oxidised or chemical oxidised. Chemical oxidation can be done using a solution of 4gm sodium borate and 5 gm acetic acid (30%) in 1000 ml water at 600 - 700C. Wash and soap at room temperature. Chemical oxidation can also be done by treating in 4g/l H2O2 and a subsequent dip in dilute acetic acid to neutralise it. rinse with water and dry.
- Rinse the sample. Soap with 2 gpl soap at boil for 5 minutes. Wash with cold water and dry.

Did You Know !!!

SHIBORI

- **Shibori** is a Japanese manual resist dyeing technique, which produces patterns on fabric. During the 8th Century, the technique of shibori first came into Japan from China. The word shibori comes from 'shiboru,' a term that means, 'to wring, squeeze, and press.'
- **The process:** During the shibori process, textile printers fold, stitch, and even bind or knot cloth (usually silk or cotton) before dyeing it.
- The hallmark of this method is that it gives fabric a three dimensional form during processes of manipulation, such as binding and knotting. Thus, a characteristic of shibori is a blurry-edged pattern, which is quite different than sharp edges created by stencils, wax or paste.
- **Motifs:** The motifs in shibori are mostly based on nature, like birds and flowers
- **Bandhani *Vs* Shibori:** If in bandhani, the artisan ties the portion of the cloth which is not to be dyed with a wax thread before dipping it in dye, the resisted portion is stitched and then pulled to make gathers in shibori
- **Main production centres of Shibori:** Presently, active production in great quantities continues in western Africa, in southern China by minority people, and in the western regions of India.

Arimatsu village in Japan is known as shibori village which also has a museum. Even today, Arimatsu and Narumi in Nagoya prefecture remain the only main production centres in Japan, where over 100 varieties of shibori is practised.

8. Quality in Dyed and Printed Fabrics

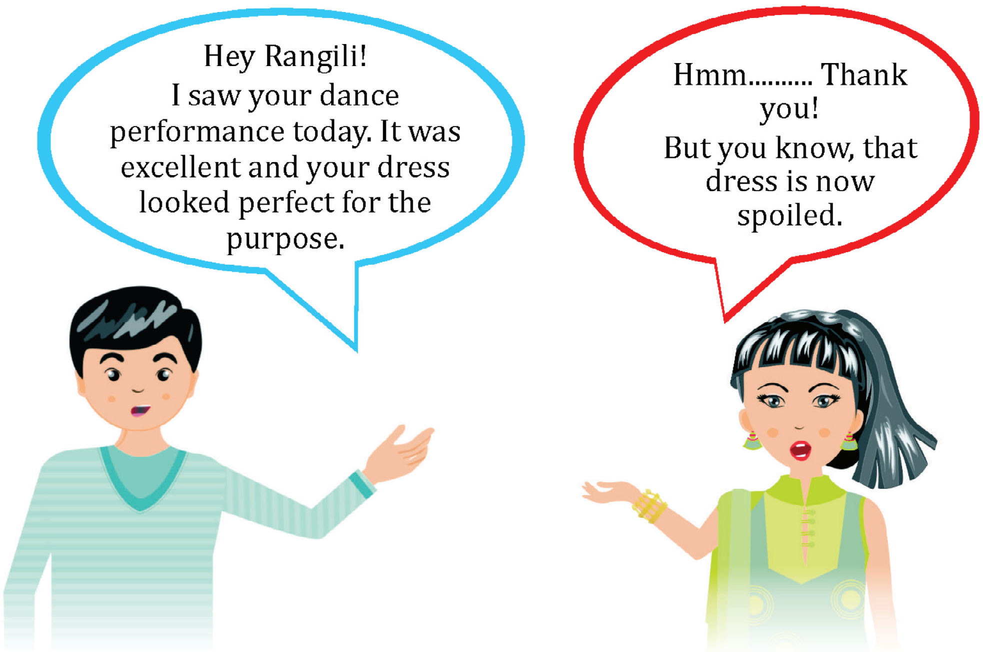
KEYWORDS

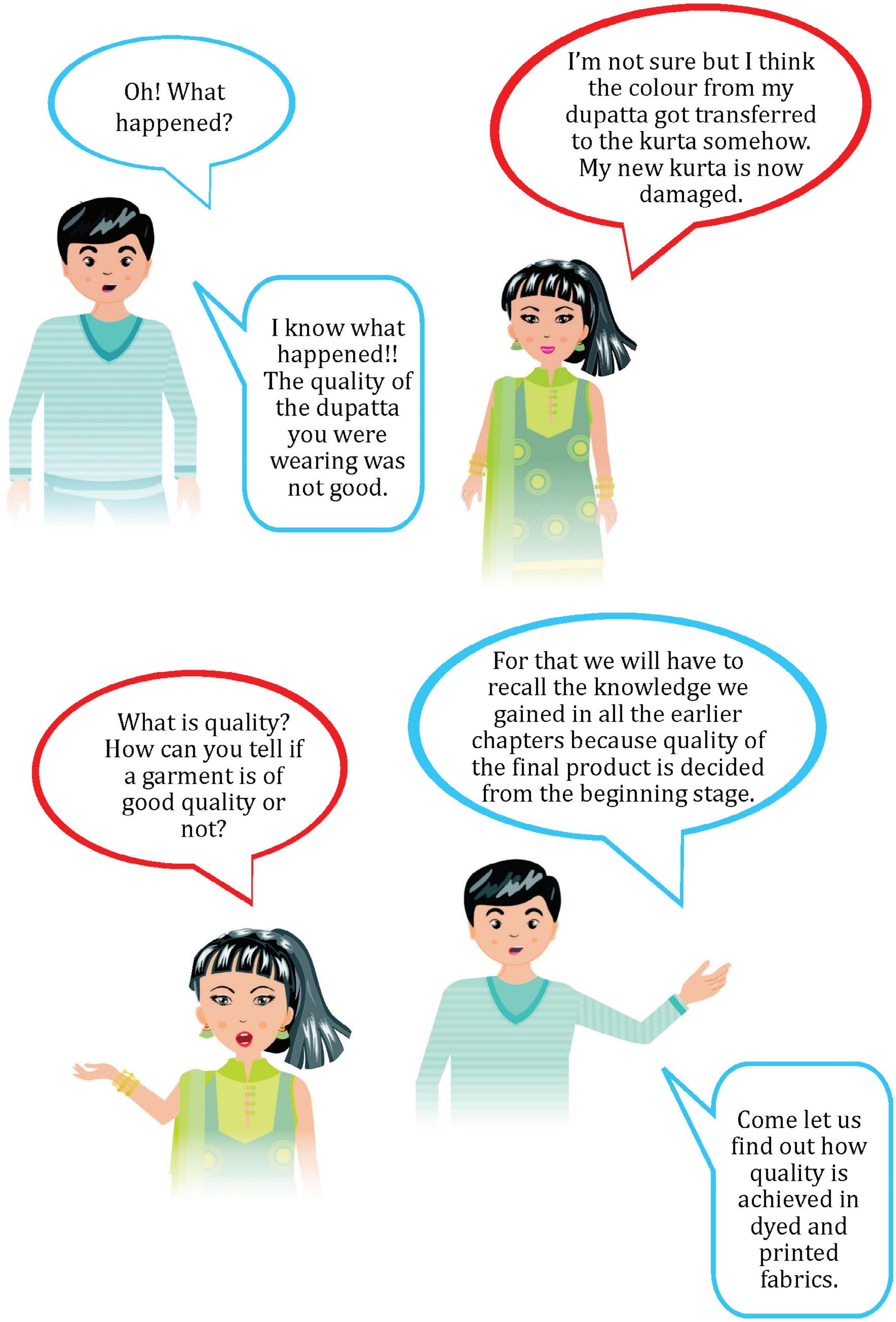
- Quality
- Dye bath
- Print paste
- Defects
- Colour Fastness
- Crocking

OBJECTIVES

- Explain the importance of quality assurance at all stages
- Identify the commonly occurring defects in dyed and printed fabrics
- List the causes for defects in dyed and printed fabrics
- Explain various types of colour fastness properties- wash, light, perspiration, rub

Rangili had a dance competition at school. She was wearing a white salwar kameez with a colourful tie-dye dupatta tied across the shoulder. After her performance, she noticed some patches of colour on her white kurta, which were more prominent at the shoulder. She wondered how that happened. Later that evening while playing:




Oh! What happened?
I'm not sure but I think the colour from my dupatta got transferred to the kurta somehow. My new kurta is now damaged.
I know what happened!! The quality of the dupatta you were wearing was not good.
What is quality? How can you tell if a garment is of good quality or not?
For that we will have to recall the knowledge we gained in all the earlier chapters because quality of the final product is decided from the beginning stage.
Come let us find out how quality is achieved in dyed and printed fabrics.

8.1 IMPORTANCE OF QUALITY ASSURANCE AT ALL STAGES

Let us understand the term quality first of all. From the above example, we know that Rangili is upset because her beautiful kurta is spoilt. It cannot be worn again. And money spent on it is wasted. Quality ensures that a consumer gets full value of their money.

But how is the quality of final product achieved? It is not a single step process. This involves ensuring and assuring that each step involved in the production is carried out carefully without any shortcomings. Thus, from the earlier chapters, you know that quality of a dyed and printed fabric would depend upon:

> The term **QUALITY** refers to the excellence of a product, in this case a coloured fabric. The quality of a product is said to be good when it serves the purpose for which it is made.

1. Use of fast dyes and pigments.
2. Use of correct methods and dyeing conditions for fixation of colour.
3. Appropriate use of dyeing auxiliaries.
4. Yarns and fabrics should be free from all possible impurities before dyeing and printed.
5. Correct application of methods with appropriate tools.
6. No hurry in performing all steps as it may lead to errors or flaws in the final product.
7. All precautions should be followed.

> To sum up, quality of the final product is not independent and isolated. Best results will be achieved only if care is taken to ensure quality at each and every step.

Know Your Progress 8.1

A. Fill in the blanks:

1. The term ______________ refers to the excellence of a product.
2. Quality of the final product is not independent and ____________.
3. Use of ______________ dyes and pigments gives good quality product.

Fill your score ______ / 6

8.2 DEFECTS IN DYED AND PRINTED FABRICS

Sometimes faults occur in the final dyed fabric even after ensuring quality at every stage. Let us look at various types of defects that may occur and how you can identify them.

8.2.1 Dyeing Defects

COLOUR BLEEDING

The loss of colour from the fabric on wetting. It may happen due to improper dye selection or poor colour fastness.

STREAKS

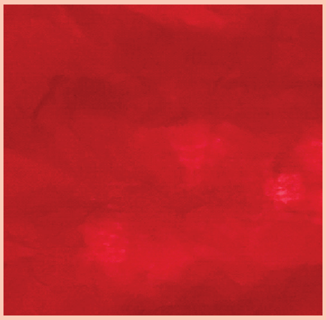
This is a very common defect which appears as stains or uneven dyeing caused by folds in the fabric during the process of dyeing.

CROCKING

Crocking refers to transfer of colour from one surface to another surface through the action of rubbing. It might be caused due to insufficient washing off after dyeing.

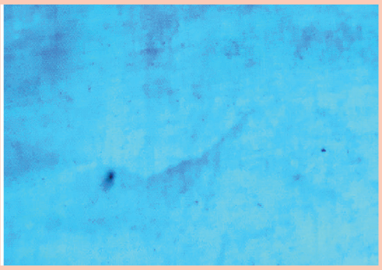
SHADING

If there is variation in colour tone of the fabric either horizontally or vertically then it is known as shading. It happens due to uneven pressure on the fabric while dyeing. It is known as patchy dyeing commonly.



STAINING

Discoloration caused by a foreign substance, dirt, grease, oil or any chemical residue present on the fabric is known as staining. This defect would happen if impurities have not been properly removed from the fabric during scouring.



8.2.2 Printing Defects

BLEBBINESS

The printed area appears very rough and coarse. It is caused by use of an unsuitable print paste and its uneven adhesion to the fabric.

WICKING/ FLUSHING

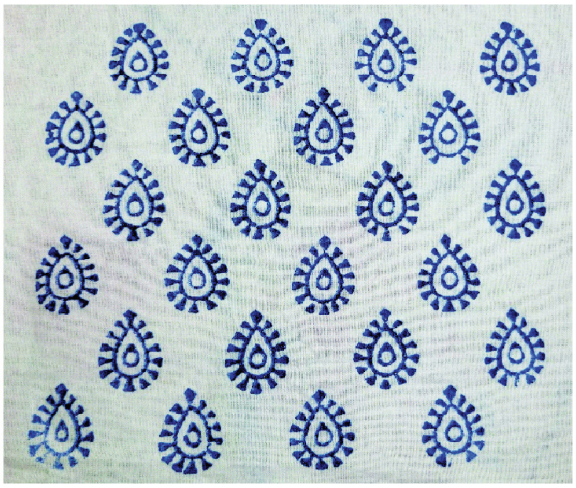
This happens when the print bleeds out onto the unprinted area of the fabric. It might happen due to low viscosity of the print paste or presence of some residual chemicals in the fabric from earlier treatments. It appears as a shadowing effect around the outline of the printed design.

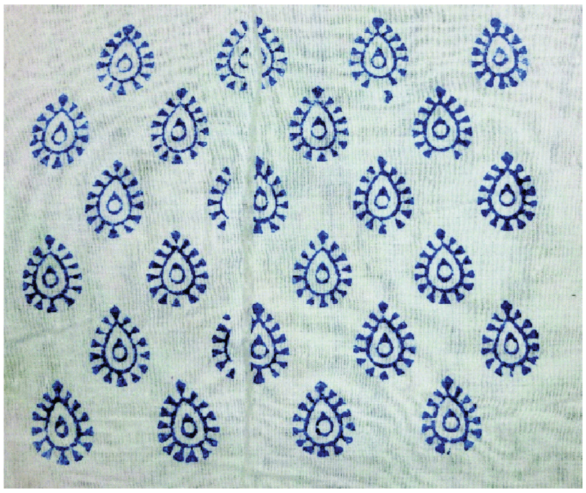
STICK-IN

Sometimes the screen mesh is blocked due to small fibres or lint. This results is a small unprinted circle in the design which generally goes unnoticed.

SCRIMP

Sometimes the fabric forms a crease while printing. This results in a band of unprinted fabric as the pattern is only printed on the top layer of the crease.





Porfolio Activity 8.1

Collect 10 dyed and printed fabrics and try to identify the various defects which you have studied above. Which is the most common type of defect you notice and what could be the reason for same?

Sample No.	Defect	Picture/Swatch
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Know Your Progress 8.2

A. Fill in the blanks:

1. Shading happens due to uneven ___________ on the fabric while dyeing.
2. Scrimp defect occurs when the fabric forms a ___________ while printing.
3. In ________________ defect the printed area appears very rough and coarse.
4. Discolouration caused by a foreign substance, dirt, grease, oil or any chemical residue present on the fabric is known as ____________.

B. Colour the bubbles blue for dyeing defects and red for printing defects:

Stick-in

Wicking

Misfit

Streaks

Crocking

Fill your score ________ / 18

8.3 CAUSES FOR DEFECTS

There are many defects as you studied in previous section, which occur in dyed and printed fabrics. Can you think of the possible reasons from the previous chapters? The following image gives the causes of defects that can occur in dyeing and printing:

As you have learned in chapter 1, colour is produced on the fabric using dyes and pigments. You have also learnt in chapter 3 that these dyes and pigments can be applied either on the fiber, yarn, fabric or a garment. You have learnt in chapter 1 that different dyes have affinity for different fibres. So they should be selected accordingly. And there are some dyes which have better fastness properties than others. So the selection of dye is very important factor in quality assurance of dyed fabrics.

Once you have selected the dye, you should take care that your dye bath or print paste is prepared using standard recipes. You have read in chapter 5 and 6 that each ingredient in the dye bath or print paste has its own importance and function, and, you cannot miss out on any of them. Chapter 2 gives a detailed list of various auxiliaries which have very important role to play in dyeing and printing of fabrics. Thus, make sure you do not miss out on any of them to avoid any fault in the final fabric.

Let us now try to relate the various defects which we learnt to the stages at which they might occur. This would help you to make careful selection at different stages to avoid any defects:

DEFECT	CAUSE	STAGE
Colour bleeding	Dye not suitable for material or poor colour fastness of dye	Selection of dye
Crocking	Washing off not done properly. Presence of unfixed dye on surface of the fabric	Washing off and dye fixation
Shading	Uniform pressure on fabric not maintained	Dyeing
Staining	Impurities not removed completely	Pre-treatment (Scouring)
Streaks	Fold in fabric as the equipment for dyeing might be too small	Dyeing
Wicking/Flushing	Low viscosity of print paste	Preparation of print paste
Blebbiness	Use of unsuitable print paste	Selection of correct ingredients
Misfit	Screens not properly aligned	Improper tools or while printing
Scrimp	Fabric not laid properly for printing	Preparation for printing
Stick-in	Blocking of screen mesh with impurities	Faulty tools and lack of proper maintenance

Another reason for defects could be the improper pre-preparation of yarn or fabric before applying colour. There are many steps like de-sizing, scouring, bleaching, mercirisation etc. about which you have learnt in chapter 4. Any deficiencies in carrying out these processes would result in a defect.

Water is the major component of the dye bath. If the water used for dyeing is too hard, then the fabric would not be properly dyed. Water might contain impurities which are again responsible for faults in final product.

You should also take care that the tools and equipment used for dyeing and printing should be cleaned properly after every use. They should be stored wisely to avoid any damage. Regular maintenance and upkeep of these tools and equipment goes a long way in helping you achieve a good quality product.

8.4 COLOUR FASTNESS

We all want our clothes to retain their colour and appearance intact for a long period of time. No one wants to spoil their new clothes like Rangili. Thus, the property of colour fastness becomes a very important selection criteria for consumers. Bleeding and fading of original colour of a fabric is a major reason of complaint among the consumers.

Colour Fastness is a property of a dyed or printed fabric which implies the resistance of the dyes used to fading and bleeding.

Can you think of reasons for fading or bleeding of dyes? Let us understand this with some examples:

Colour Fastness is a property of a dyed or printed fabric which implies the resistance of the dyes used to fading and bleeding.

1. You must have observed that after some washes, the colour of your shirt/kurta becomes dull and faded. Have you ever wondered why?

2. Or you may have noticed some discoloured patches on the armpit area of your clothes. What is the reason for it?

3. Another example could be the window curtains in your home. Don't you think they appear faded than rest of the curtains in your home?

4. Then, there is the example of Rangili's dupatta, which spoiled her white kurta. How did this happen?

The answer to all these questions is colour fastness. Various factors like washing, dry cleaning, rubbing, perspiration, exposure to sunlight, bleaching, heat, etc. can lead to loss of colour from the fabric.In all the above examples, you can observe the action of these factors on coloured fabrics. In first example, light or washing might be responsible for fading of the clothes. Second example shows the action of perspiration on the coloured fabrics. In third example, exposure to sunlight is the reason for faded curtains. In the last example, rubbing of dupatta with the kurta led to transfer of colour. The effect of these agents is not constant on all kinds of coloured fabrics. There may be some dyed fabrics which have poor colour fastness to perspiration but a good fastness to sunlight; such a fabric would be suitable for window curtains. Let us learn about these colour fastness properties in detail.

LET'S REVISE!!!

Now you know from chapter 1 that various dyes have different colour fastness properties. Let's revise them again in the following table:

Dye Class	Fabric	Wash Fastness	Light Fastness	Perspiration Fastness	Crock Fastness
Direct	Cotton, Silk	Poor	Good	Good	Very good
Reactive	Cotton, Silk, Wool, Nylon	Very good	Very good	Good	Good
Acid	Silk, Wool, Nylon	Very good	Good	Fair	Excellent
Vat	Cotton, Linen, Rayon	Excellent	Good	Good	Fair
Azoic	Cotton	Excellent	Very good	Fair	Very poor
Sulphur	Cotton	Good	Fair	Poor	Good
Basic	Acrylics	Fair	Fair	Fair	
Disperse	Polyester	Good	Good	Good	Good

8.4.1 Colour Fastness to Washing

Many times you must have observed that coloured fabric bleeds during washing and stain other fabrics. This happens due to poor wash fastness.

You can test the colour fastness to washing of a fabric at home. It would not give the accurate results but it can indicate if the fabric is going to fade on subsequent washing. For conducting this test, wash a small piece of fabric in regular detergent. Now observe the colour of detergent solution. If the dye is bleeding it would be visible with the change in colour of the original solution. After washing, rinse the fabric and iron it when it is still wet, keeping a white cotton fabric on top. If the white fabric is stained then the dye is not fast and it would cause staining of adjacent fabrics while washing.

The colour fastness to washing of a fabric is the property which indicates its resaistance to bleeding and fading during washing.

Facts!!

LAUNDER-O-METER is a machine to test wash fastness commercially.

GREY SCALES are grading system which have rating from 1 to 5:

5- Excellent colour fastness

4- Good colour fastness

3- Fairly good colour fastness

2- Fair colour fastness

1- Poor colour fastness

Portfolio Activity 8.2

Seema bought a new bright coloured cotton kurta and after wearing it for a party she washed it along with a white shirt. The colour of the kurta bled onto the white shirt. Can you state a reason why this happened?

8.4.2 Colour Fastness to Light

Have you ever noticed that your mother generally dry the clothes inside out? Why does she do that?The reason is to prevent fading of colour due to exposure to sunlight. You have learned earlier, sunlight is an oxidising agent which might affect the coloured fabrics negatively.

The colour fastness to light of a dyed and printed fabric is an important property which indicates the resistance to fading when exposed to a light source.

The test for light fastness can be done at home by exposing the fabric to sunlight for 20-30days. The fabric exposed should be covered in half using an opaque paper and kept in sunlight daily. Keep observing the changes in colour after every few days and keep a track of number of hours of exposure. If the fabric shows noticeable fading, then the fabric is not colour fast to light. This procedure is subjective in nature and the results may vary as the intensity of sunlight and exposure time may vary from day to day.

Facts!!

LIGHT FASTNESS TESTER is a machine to test light fastness commercially.

BLUE WOOL SAMPLES are used to measure the degree of fading.

Rating is given from 1 to 8.

Fabrics having a rating of 1 have very poor light fastness and fabrics having a value of 8 are fast to light.

8.4.3 Colour Fastness to Perspiration

Perspiration can also cause the colours to fade. You must have observed prominent discolouration of the garments at certain areas like underarms(Image 8.1) or back as these body parts have more sweating.Humansweat can be acidic or alkaline, thus, affecting the colour to fade rapidly. Perspiration fastness becomes an important criteria for selection of sportswear, under garments,garments meant for special occasions and other clothes which are tight fitting.

The resistance of a dyed and printed fabricto the action of acidic or alkaline perspiration is known as fastness to perspiration.

Image 8.1: Discolouration due to sweating
Source: Taken by author

Facts!!

PERSPIRATION TESTER or PERSPIRE-O-METER is used to test perspiration fastness commercially.

GREY SCALES are used for rating the tested samples.

The test for perspiration fastness of a coloured fabric is not easy to do at household level. Dip the fabric in dilute acetic acid for 10-15 minutes. Roll the fabric in an undyed cloth without rinsing and keep it away for few days. If you observe a change in colour of the original fabric or staing of the undyed cloth, then the fabric is not colour fast to perspiration.

Portfolio Activity 8.3

Take out some of your kurtis or blouses or shirts which you wear frequently. Examine the area around the armpits, neck and back. What do you think is the reason for discolouration of these areas?

8.4.4 Colour Fastness to Rubbing/Crocking

From the conversation between Rang and Rangili, we know that Rangili's dupatta had poor quality. What exactly was the problem with Rangili's dupatta? It had poor rub fastness. Rub fastness of a fabric refers to the resistance towards change in colour due to the action of rubbing. It is difficult to avoid rubbing of clothes in normal day to day activities, thus, this property becomes very important while selection. Some garment areas (like collars, hems, cuffs) and the upholstery fabrics are more likely to crocking.

Crocking refers to transfer of colour from one surface to another surface through the action of rubbing.

It is quite easy to do this test yourself. Take a piece of white cotton fabric (de-sized) and rub it against the fabric you want to test. Try to keep the pressure of your hand constant and repeat the rubbing action 10 times. Notice if there is colour transfer to the white cotton piece. If there is no staining, it indicates that the fabric has good crock fastness. Repeat the test with a damp cotton piece to see the change in colour in wet conditions.

Facts!!

CROCKMETER is used to test rub fastness commercially.

GREY SCALES are used for rating the tested samples.

Know Your Progress 8.3

A. Match the following:

i. Light fastness tester	a. Rub fastness
ii. Crock meter	b. Blue wool standards
iii. Launder-o-meter	c. Colour fastness to perspiration
iv. Perspiration tester	d. Grading system
v. Grey Scales	e. Wash fastness

B. State whether the following statements are True (T) or False (F):

i. Acid dyes are suitable for Silk, Wool and Nylon.

ii. Vat dyes have poor wash fastness.

iii. Blue wool samples give a rating from 1 to 5.

iv. Colour Fastness is a property of a dyed or printed fabric which implies the resistance of the dyes used to fading and bleeding.

v. Rating of 1 on a grey scale means excellent colour fastness.

Fill your score ________ / 20

8.5 THIS IS WHAT YOU HAVE LEARNT

Correct selection of dye or pigment for selected fabric + **Standard dye bath or print paste** + **Fabric properly pre-treated** = **GOOD QUALITY**

CAUSES FOR DEFECTS

- Fabric
- Water
- Improper dye bath or print paste
- Faulty tools or equipment

COMMON PRINTING DEFECTS

- Wicking/ Flushing
- Blebbiness
- Misfit/ Out of Registration
- Scrimp
- Stick-in

COMMON DYEING DEFECTS

- Colour bleeding
- Crocking
- Shading
- Staining
- Streaks

COLOUR FASTNESS

- Wash Fastness
- Light Fastness
- Perspiration Fastness
- Crock Fastness/ Rub Fastness

8.6 LET US PRACTICE

1. List the various causes responsible for defects in dyed and printed fabrics.
2. What are the common defects in dyed fabrics?
3. Explain the various defects which can occur in printed fabrics.
4. What is colour fastness?
5. How will you test the fastness of a coloured fabric to washing yourself?
6. What is the method to test crocking at home?

8.7 ANSWERS TO KNOW YOUR PROGRESS

Answers to Know Your Progress 8.1

A. 1. Quality

2. Isolated

3. Fast

Answers to Know Your Progress 8.2

A. 1. Tension

2. Crease

3. Blebbiness

4. Staining

B. Dyeing defects (Blue): Crocking, Streaks; Printing defects (Red): Misfit, Stick-in, Wicking

Answers to Know Your Progress 8.3

A. i. (b)

ii. (a)

iii. (e)

iv. (c)

v. (d)

B. i. T

ii. F

iii. F

iv. T

v. F

Fill your score ______ / 44

PRACTICAL WORK

Practical 8.1

WASH FASTNESS

Objective: To determine the wash fastness using the Launder-o-meter of the given dyed cotton fabrics.

Materials Required: Launder-o-meter, soap solution, white cotton fabric, white wool fabric, grey scales, needle and thread

Procedure:

1. Cut a 10 cm × 4 cm piece from the given dyed fabric. This piece is then sandwiched between two layers of fabric of same size. First fabric is the same as the test sample and the other fabric is complimentary backing as per the table given below:

TEST FABRIC	SECOND PIECE OF FABRIC
Cotton	Wool
Wool	Cotton
Silk	Cotton
Linen	Cotton
Polyester	Wool
Acrylic	Wool

2. Prepare the required volume of washing solution. Heat the solution to the temperature according to prescribed standard.
3. Adjust the launder-o-meter to the required temperature.
4. Pour the liquor into each container according to the MLR.
5. Enter the sandwiched sample into these containers.
6. Put the containers in the launder-o-meter and run the machine for prescribed time period.
7. After that, stop the machine and take out the samples from the containers.
8. Wash the samples under running water.
9. Let the samples dry in shade. After drying compare them with original fabric. Assess the fading and staining with the help of grey scale and assign corresponding values.

Test	Wash solution	MLR	Time	Temp. °C
ISO I	5% soap solution	50:1	30 min	40 ± 2
ISO II	5% soap solution	50:1	45 min	50 ± 2
ISO III	5% soap solution + 2gpl Na_2CO_3	50:1	30 min	60 ± 2
ISO IV	5gpl soap + 2gpl Na_2CO_3	50:1	30 min	95 ± 2
ISO V	5gpl soap + 2gpl Na_2CO_3	50:1	4 hours	95 ± 2

Precautions:

1. The fabrics which are used for sandwiching the sample should be firmly attached and should remain fastened throughout the procedure.
2. Equal volume of wash solution should be poured into all the containers.
3. The containers should be tightly clamped to avoid any loss of solution.
4. The machine should be run for the specified time period at the indicated temperature.

Practical 8.2

PERSPIRATION FASTNESS

Objective: To determine the fastness to perspiration of the given dyed cotton fabrics.

Materials Required: Perspiration tester, artificial perspiration solution, white cotton fabric, white wool fabric, oven, grey scales, needle and thread

Procedure:

1. Preparation of artificial perspiration solution:

   Take one litre of distilled water. Add the following chemicals in it:

   a. 10 gm NaCl

   b. 1 gm Lactic Acid (85%)

   c. 1 gm Di Sodium Hydrogen Phosphate (anhydrous)

   d. 0.25 gm of Histadine Mono Hydrocholride

2. Check the pH of the prepared solution with the help of pH paper. The pH range should be 4-4.5 for the accuracy of this test.

3. Preparation of the test sample:

   Cut a sample from the dyed fabric measuring 10 cm × 4cm. This sample is sandwiched between a white cotton fabric and a white complimentary backing (according to the table given in earlier practical) of same size. The three layers are stitched together from all the sides to keep them fastened.

4. Take the test sample and dip it in the artificial perspiration solution for 30 minutes.

5. Now place the samples between the acrylic plates of the perspiration tester, distributing them evenly.

6. After putting all the plates into the tester, place the weight on top and lock the pressure plate by turning the thumbscrew. Remove the pressure plate and put the tester in the oven.

7. Heat the oven to 37 ± 2 °C for six hours. Remove the samples from oven and air-dry them.

8. Separate the sandwiched samples and compare them with original samples. Give the rating with the help of grey scales.

Practical 8.3

CROCK FASTNESS/ RUB FASTNESS

Objective: To determine the rub fatness (Dry and Wet) of the given dyed cotton fabric.

Materials Required: Crock meter, white cotton fabric, grey scales, needle and thread

Procedure:

1. Cut out a sample measuring 25 cm × 5 cm from the dyed fabric to be tested.
2. Place the test sample on the base of the crock meter resting flat on the abrasive cloth with its long dimension in the direction of rubbing.
3. Place the sample holder plate to prevent the sample fabric from slipping.
4. Mount a white test fabric (5 cm × 5 cm) on the end of the finger which is projecting downward from the weighted sliding arm.
5. Lower the covered finger on the test sample and move the handle for 10 complete turns (20 times to and fro) at the rate of one turn per second.
6. Remove the white cloth and evaluate the samples using grey scales for fading and staining.
7. In order to test the wet rub fastness, thoroughly wet the white cotton piece in distilled water before mounting it on the finger of the crock meter. Repeat step 5.
8. Air dry the wet test sample before evaluating.
9. Rate the amount of colour transferred from the specimen to the white cotton fabric using grey scale for staining. Rate the fading or loss of colour from the dyed fabric using grey scale for fading.

Did You Know !!!

TRADITIONAL INDIAN PRINTED FABRICS

CHINTZ- The word "chintz" is derived from Hindi word 'chhint or chint' meaning spotted or bright. In the 17th century, plain weave cotton fabrics that had been hand-painted or block printed in India with brilliantly colored patterns of plants and animals were imported to Europe and America. These unique fabrics were used for gowns, dresses, lounging jackets, robes, bed hangings and coverings, and household textiles. The characteristic print of chintz is a large floral pattern, and the finish is glossy from glazing. It is of cotton or a cotton blend, in a plain weave. The glaze can be starch or wax or a more durable chemical resin.

BAGH- Bagh printing is traditional hand printing done in the remote areas of Bagh located in the Dhar district of Madhya Pradesh, India. The design of Bagh prints covers geometrical and floral compositions and the blocks used for stamping are intricately and deeply carved by block-makers of Pethapur in Gujarat. The bagh prints have a distinctive muted loveliness which mimic the best and most sophisticated screen printing. The Bagh textiles are extremely soft which is attributed to the repeated washes they get in the *Bhagini* River.

AJRAKH- The history of the Ajrak can be traced back to the civilizations of the Indus Valley that existed around 2500 BC-1500 BC. The term "Ajrak", may be derived from "Azrak", meaning blue in Arabic, as blue is the one of the principal colours in Ajrak printing. Traditionally, Ajrak is the name of a block printed cloth with deep crimson red and indigo blue background, bearing symmetrical patterns with interspersed unprinted sparkling white motifs. The Ajrak print is employed within a grid, the repetitive pattern creating a web-like design or the central jaal. Apart from this jaal, border designs are also employed in the fabric. Common colours used are blue, red, black, yellow and green.

KALAMKARI- Kalamkari is a type of hand-painted or block-printed cotton textile, produced in parts of India and Iran. Its name originates in the Persian words qalam (pen) and kari (craftsmanship), meaning drawing with a pen. There are two distinctive styles of kalamkari art in India - the Srikalahasti style and the Machilipatnam style. The Srikalahasti style of kalamkari, wherein the "kalam" or pen is used for free hand drawing of the subject and filling in the colors, is entirely hand worked. This style flowered around temples and their patronage and so had an almost religious identity. The Machilipatnam Kalamkari craft made at Machilipatnam in Krishna district, Andhra Pradesh, evolved with patronage of the Mughals and the Golconda sultanate.