LESSON 10  PREPARATORY PROCESSES AND DYEING

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10. PREPARATORY PROCESSES AND DYEING

Textile Chemical Processing involves processes like dyeing, printing and finishing of textiles. However, the textile product has first to be cleaned up to make it receptive to the dyes and other chemicals that are used for these processes. Thus, the preparatory processes are an intrinsic part of textile chemical processing. In this first lesson of the unit, we will first deal with the preparatory processes and then move on to consideration of Dyes and Dyeing. In lesson 11 you will be introduced to printing and finishing processes. The final lesson of this unit will be devoted to tests for colour fastness.

10.0 Objectives

After going through this lesson, you will gain an understanding of:

- The need for and importance of preparatory processes.
- The preparatory processes for different textile materials
- The various dyes available for colouring textiles, and
- The dyeing process for different textiles.

10.1 Introduction

The story of textiles starts with fibres and filaments, which are the starting materials for making any textile product. From these, one moves to yarns and then to fabrics. These three textile forms, viz. the fibre, the yarn and the fabric were considered in the first, second and third units, respectively of this course on ‘Introduction to textiles’. This fourth unit on ‘Textile Chemical Processing’ deals with the subsequent processes to which textile products are subjected, viz dyeing, printing and finishing, which add value to these products. However, before the textile products undergo these processes they have to be cleaned to make them receptive so that dyes, pigments and finishing agents can enter the textile material or adhere to it. If they are not appropriately cleaned, the colouration and finishing will be faulty. We will therefore discuss the preparatory processes first. After that Dyes and Dyeing will be described.

10.2 Nature of Impurities

In the first lesson of this course, textiles were classified according to their origin and it was stated that natural fibres are much more non-uniform than man-made fibres. It is noteworthy that natural fibres also contain a much greater degree of impurities
compared to man made fibres. Natural fibres like cotton and wool take a long time to grow and during growth and collection they are exposed to rigours of environmental elements when impurities multiply. Therefore they need relatively more severe cleaning treatments.

These impurities may be a part of the raw fibre itself like cotton and wool contain natural fats and waxes or they may be added impurities like spinning lubricants, etc. All these must be removed. In addition, a fibre like cotton contains a natural colouring matter which must be removed if whiteness is desired. Several stages are involved in the preparation of a textile for dyeing, printing or finishing. However it is not necessary to subject all the textiles to all the stages. We will first describe the various stages of preparation for cotton fabrics and then discuss the requirement for individual fibre systems.

10.3 Preparatory Processes for Woven Cotton Fabrics

The sequence of operations for a woven cotton fabric is singeing followed by desizing, scouring, bleaching and mercerizing before it is dyed, printed or subjected to finishing treatment.

Singeing

Singeing removes the surface hairs of woven cotton fabrics by passing them at great speed through a naked gas flame so that the surface fibres or hairs are burnt away (fig.10.1). This method is suitable for removing hairs of cotton or other cellulosic fibres because they form a light dusty ash which can be easily removed. It is not suitable for woollen fabrics as a hard residue is formed, nor is it suitable for fabrics made from synthetic fibres which distort and get discoloured when singed.

Desizing

The next step is desizing, i.e. removal of the sizes which are applied to the warp yarns of woven fabrics to assist in the weaving process. The size makes the yarns stick to each other and thus the stresses present during weaving are shared more equitably. In the case of cellulosic fibres and cellulosic blends with man-made fibres, starch based sizes
are used while man-made fibre fabrics are sized with water soluble sizes like those based on polyvinyl alcohol and polyacrylic acid. However, often the sizing agent used is a mixture in which starch is also present. The removal of the size involves the degradation of starch into smaller fragments, which can then be removed by water treatment. For this the cloth may be soaked in dilute solution of dilute sulphuric acid or hydrochloric acid (0.5 to 1.0 percent concentration on weight of the fibre) for two to three hours. It is essential that after the starch has degraded, the acid is neutralized quickly and fully, otherwise, the fabric will be affected.

Use of oxidizing agents like hydrogen peroxide to remove the size is often preferred, as they degrade starch without affecting the fabric. For this the fabric is soaked in a hot solution of the oxidizing agent. Since hydrogen peroxide is also used as a bleaching agent, the two processes of desizing and bleaching may be combined.

A biochemical method of enzymatic desizing is preferred to remove starch as it is the safest method with regard to fibre damage as the enzyme acts only on the starch.

Scouring

Scouring plays an important role in the cleaning up process. It removes natural fats and waxes present in the fibre. It also removes seed fragments, any remaining water soluble impurities and also any soil, husk, etc which may have been trapped in the fibre mass during collection and transport.

The traditional scouring for cotton goods involves treatment with sodium hydroxide solution at quite high temperature. A continuous scouring process is shown in Fig.10.2.

Bleaching

If the cloth is to be finished white or given ornamentation, all natural colour must be removed by bleaching. Bleaching completes the removal of impurities by ensuring that the colouring matter is destroyed or converted to colourless products and the seed and husk are removed.

The bleaching may be done with calcium hypochlorite or sodium hypochlorite or hydrogen peroxide. Bleaching is classified into three types:
Full bleach: Full bleach is done when highest degree of whiteness is required, particularly when the fabric is going to be used as undyed fabric or for fabric to be printed with white background. It is achieved by initially bleaching with mild hypochlorite followed by hydrogen peroxide bleach.

Half bleach: Half bleach is done for fabrics meant for dyeing and printing. This is done by using hypochlorite or hydrogen peroxide. The hydrogen peroxide may be incorporated in the scouring process itself.

Bleaching of coloured fabrics: This third category of bleaching is achieved by a much milder process.

Mercerization

Mercerization is an important preparatory process only for cellulosic fibres and is not a purification process in the usual sense, rather it is a stabilization process. It alters the chemical and physical properties of the fibre. The fibre becomes more lustrous, stronger, more extensible and develops a softer handle. It also becomes more receptive to dyes and finishing agents.

The process of mercerization was developed in 1884 by John Mercer in England. The process as practised now consists of passing the fabric through a cold 15 to 20 percent solution of caustic soda under tension. The cotton fibre deconvolutes resulting in a smoother surface with high luster. Since polyester can withstand this treatment, cotton polyester blends can also be subjected to mercerization.

The fabric is now ready for the dyeing, printing and finishing processes. However, it must be stated that mercerization increases the fabric cost significantly and not all cotton fabrics are mercerized.

10.4 Preparatory Processes for Other Textiles

Woollen fabrics undergo scouring followed by milling, carbonization and neutralization before they are ready for dyeing, etc. It has already been stated earlier that the hair in wool fibres are not removed by singeing because they leave hard residue. This job is done by a cropping machine which removes the hair mechanically by slicing them with a series of helical blades. Wool warps are not sized so there is no desizing needed.

Wool is scoured in loose stock to make it possible to spin. It is given a soap and soda scour by passing the fibre through a series of several long narrow tanks containing soap or non-ionic synthetic detergent and sodium carbonate (soda ash) at 45-55°Celsius. The scouring may also be done in the yarn or fabric form.

Wool fibre contains many vegetable impurities and carbonizing is a chemical treatment with 5 to 6 percent hydrochloric or sulphuric acid to remove them. The goods are then neutralized and rinsed.

Bleaching is difficult with wool because of its chemical sensitivity and is only done when absolutely necessary. Bleaching of wool is done with reducing agents or with hydrogen peroxide.
Milling is the process of deliberately felting woollen goods to achieve an entangled web of fibres.

Silk fibres undergo the following sequence of chemical processing - degumming, bleaching, weighting, dyeing, printing and finishing. In the raw silk filament obtained from the cocoon, there is 20 to 30 percent protein called sericin. This and the other impurities make the silk coarse and lacking luster. The process of removing sericin or gum from raw silk is known as degumming. Sericin dissolves in hot water especially that containing soap or alkali. It can also be removed by enzymes.

The weighting of silk is done by treating it with tin salts to increase the weight of the fabric and improve its hand and drape.

The preparation of synthetic fibre textiles starts with desizing and then goes on to mild scouring, drying, heat setting, bleaching, etc. The scouring is mild because only limited impurities are present. The heat setting step stabilizes the fabric so that it does not shrink or distort during the subsequent operations.

**Activity**

1. Take half a metre of cotton fabric and do the following:
   - Weigh the fabric.
   - Perform scouring of the fabric by boiling the material in water for an hour with 2 gms / litre of grated soap and 2 gms / litres of soda ash.
   - After drying, again, weigh the fabric and note if there is any change in weight.

**Self-check Questions**

1. List the impurities present in a grey cotton fabric.
2. Define singeing process.
3. What do you mean by desizing process?
4. Define milling process.
5. What is bleaching?
6. Who developed the mercerization process and when?
10.5 Dyes and Dyeing

Dyes are organic compounds which are widely used for imparting colour to textiles through two important chemical processes, viz., dyeing and printing. In this lesson various aspects related to dyes and dyeing will be considered with emphasis on the dyeing of cotton textiles, though the dyeing of other fibre types will also be described briefly.

The dye molecules selectively absorb and reflect incident white light and it is the reflected wavelength which gives the observed colour to the textile product. They do this because of the presence of unsaturated organic radicals. The loosely held electrons in the unsaturated bonds cause an absorption of certain incident light waves and the selective reflection of others - this imparts colour. The absence of free radicals will render the molecule colourless.

The purpose of dyeing is not only to impart colour to the fibre, but the dyed fibre must also retain the dye - the colour should not fade when the fabric is exposed to sunlight, the colour must not run off when the fabric is subjected to rubbing and or washing. In short colour fastness to various agencies is desirable. This will depend to a large extent on the force of attraction between the dye and the fibre and also on factors like the structure of the fibre, the physical state of the dye inside the fibre, etc.

Upto the middle of nineteenth century, the dyestuffs used on textiles were obtained from natural sources — vegetable, animal and mineral. As these dyes were not simple water-soluble substances, complex procedures were used to give rich and fast (but expensive) colours. In 1856 a British Chemist, W.H. Perkin, produced a brilliant mauve dyestuff from coal tar which was the first synthetic dyestuff. This led to an understanding of the chemistry of dyes and a number of synthetic dyes were developed with the result that by the end of the nineteenth century, the natural dyes were almost completely superseded by synthetic dyes. Interestingly there has been a spurt of activity in the recent past relating to the use of natural dyes for colouring textiles, mainly because of environmental and health concerns.

Dyeing is usually carried out by immersing textile materials in an aqueous solution of the dye called dye liquor. Normally the dye liquor consists of the dye, water and an auxiliary. Heat may sometimes be applied to improve the effectiveness of dyeing. In case an organic solvent is substituted for water (this happens only rarely) the theory of aqueous dyeing has to be modified.

The dye molecule leaves the aqueous dye liquor and enters and attaches itself to the polymeric fibre because repulsive forces may develop between the dye molecule and water and attractive forces exist between the dye molecule and fibre. The dye molecules can be anionic, cationic or disperse. While in the first two cases, an aqueous solution is prepared, disperse dyes are applied from an aqueous dispersion. Also while the anionic and cationic parts respectively of the molecules are responsible for the colour in the first two cases, in the case of disperse dyes, colour is caused by the whole molecules.

Electrolytes such as sodium chloride or sodium sulphate are added to the dye liquor to make it more ionic— this increases the forces of repulsion between the
electrolyte and the dye molecule and makes the dye move towards the fibre. The application of heat not only increase the rate of dyeing but also swells the fibre so that the dye entry is facilitated.

A number of dye auxiliaries are used, e.g. carriers or swelling agents, levelling agents, anti-foaming agents, dispersing agents, detergents and wetting agents.

10.6 Classification of Dyes

Dyes may be classified either on the basis of their chemical constitution or according to the method of their application— the latter will be described here.

As was seen in Lesson 1, a large number of textile fibres are in use. These different fibres have different chemical structures and therefore a wide range of dyes with a variety of chemical structures are required for dyeing them. Based on their method of application, they can be classified as:

Water soluble dyes:

1. Direct dyes
2. Acid dyes
3. Metal complex dyes
4. Basic or cationic dyes
5. Reactive dyes
6. Solubilised vat dyes

Water insoluble dyes:

1. Vat dyes
2. Sulphur dyes
3. Disperse dyes

In-situ colour formation:

1. Azoic colours
2. Aniline Black

In addition to the above, pigment colours are also used. They have no affinity to any fibre and are therefore applied by special techniques such as use of binder or using special auxiliaries.

The suitability of these dyes for different fibre types and the forces which hold the dye in the fibre, are shown in Table 10.1.
Table 10.1: Suitability of dyes for fibres and the forces of attraction which hold them

<table>
<thead>
<tr>
<th>Fibre class</th>
<th>Dye class</th>
<th>Force of attraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulosic: cotton, jute,</td>
<td>Direct, Vat, Solubilised vat, Sulphur</td>
<td>Hydrogen bond, van der Waals forces</td>
</tr>
<tr>
<td>regenerated cellulose, etc.</td>
<td>reactive</td>
<td>Covalent bond</td>
</tr>
<tr>
<td>Protein/Polyamide: Wool,</td>
<td>Direct, acid, metal complex, base</td>
<td>Ionic or electrostatic force</td>
</tr>
<tr>
<td>Silk, Nylon</td>
<td>reactive</td>
<td>Ionic/covalent bond</td>
</tr>
<tr>
<td>Polyester</td>
<td>Disperse</td>
<td>Hydrogen bond, Van der Waals forces</td>
</tr>
<tr>
<td>Acrylic</td>
<td>Basic</td>
<td>Ionic or electrostatic force</td>
</tr>
</tbody>
</table>

From the above table, one could conclude that since the covalent bond is stronger than other bonds, the fastness properties of reactive dyes should be outstanding while the other dyes, which form hydrogen or van der Waals bonds, are not as fast. While this conclusion is true when comparing reactive dyes with direct dyes for dyeing cotton, it does not hold for vat dyes. Though vat dyes bond weakly to cotton fibre, the wash fastness of this system is extremely good. This is explained in terms of the following two factors:

- Insolubility of the dye in water, and
- Aggregation of the dye molecules within the fibre (during soaping).

Thus besides the types of bonding, other characteristics should also be considered as they play an important role in controlling wash fastness. Similar situation exists for polyester fibres dyed with disperse dyes, which also show excellent wash fastness inspite of weak molecular forces between the dye and the fibre.

Before taking up individual dye systems, it may be instructive to briefly consider some important aspects of the dyeing process.

### 10.7 Some Aspects Related to the Dyeing Process

It is worth remembering that as far as dyeing of cotton is concerned, a number of preparatory processes have to be undertaken to get rid of natural and added impurities. The processes of desizing, scouring, bleaching, etc. are well known and have been dealt with here. Here some general preliminary information relating to dyeing of textile fibres will be given as it will assist in following what comes later. It is useful for the dyer to have some idea of the dye that is going to be used in the dyeing process. Though the types of fibre and dye, the conditions of dyeing, the depth of shade and such factors will determine the amount of dye that will be needed, broadly speaking rough figures can be
given for different shades of dyeing, viz., that on the weight of the material to be dyed, the following amounts of dye will be generally used:

- For light shade: 0.5 to 1.0% dye
- For medium shade: 1.0 to 3.0% dye, and
- For dark shade: Greater than 3.0% dye.

The dye solution is generally made in water (In recent years, the use of water and its disposal in a non-polluting form has become more expensive. Organic solvents have been tried as an alternative but they are expensive and have not caught on). The material to liquor ratio indicates the weight—volume relationship between the fibre to be dyed and the total volume of the dye bath. It is normally denoted by M:L ratio. For example, M: L ratio of 1:10 means that for dyeing 1 kg. of fibre, the volume of the dye bath is 10 litres. In practice in general this ratio is kept in the range 1:20 to 1:30. The dyeing is then done in the dye bath under conditions to be described while discussing individual dyes. However, one should be familiar with the term exhaustion which is a measure of the proportion of the dye absorbed by the fibre compared to that in the dye bath. Thus it indicates the amount of dye gone from solution to fibre under given dyeing conditions. It is a measure of the affinity of a dye for a fibre (affinity indicates the ability of dye to go from solution phase to fibre). The term is mainly applicable to batch-wise dyeing which is also called exhaust dyeing.

10.8 Different Types of Dyes

10.8.1 Vat dyes (also solubilised vat dyes)

Natural and man-made cellulosic fibres are most readily coloured by vat dyes and they provide the textile materials with the best colour fastness of all the dyes in common use.

Indigo is one of the oldest natural vat dyes. Synthetic vat dyes have been produced since early 1900’s and are based on indigo and anthraquinone. The size of vat dye molecule is much larger than the size of the molecules of other common dyes listed earlier and is an important factor in its excellent fastness property—the second important factor being its aqueous insolubility. The anthraquinone molecule being larger than the indigo molecule leads to superior fastness properly in dyes based on it.

Dyeing of cotton with vat dyes is based on the principle of converting water-insoluble vat dye by alkaline reduction to a water-soluble leuco compound having affinity to cotton. After dyeing, the leuco compound is converted back to parent water-insoluble dye inside the fibre. The following steps are involved in this process. First the insoluble vat dye is dispersed in water. The second step involves the reduction of the vat dye to its leuco form which is soluble in water. To achieve this sodium hydro-sulphite, sodium hydroxide and water are required. The sodium hydrosulphite chemically reduces the vat dye in alkaline conditions created by the presence of sodium hydroxide. This is called vatting and during this stage, the original colour of the dye is temporarily altered.

The solubilised vat dyes have affinity to the cellulose molecule; however the exhaustion of the dye bath is facilitated by the addition of an electrolyte to the dye liquor. Neutral salts like sodium sulphate or common salt can increase the affinity of leuco dyes
for the fibre and are used as electrolyte. The temperature of the dye bath depends on which solubilised vat dye is used and varies from 20°C to 60°C. During dyeing, the textile material must be kept immersed in the dye liquor to prevent premature oxidation of the leuco compound.

Once the leuco form of the vat dye is inside the polymeric fibre, it has to be oxidized and converted to its original colour and regain its insoluble form. Oxidation of the leuco compound can be achieved by exposing the textile material to atmosphere oxygen (skying/airing) though this occurs rather slowly. Treatment with sodium perborate or hydrogen peroxide provides a more rapid rate and is extensively used.

During the above operations some insoluble vat dye may be deposited on the surface of the textile material. Treating the material at boil in an aqueous solution of surfactant (detergent), an operation generally referred to as soaping (before surfactants/detergents were developed, soap was used— therefore the term soaping). The fabric is then subjected to hot and cold washing.

A number of vat dyes are available which may be considered under the following four groups:

- IK
- IW
- IN and
- IN special

The dyes under group IK are diminishing in importance as they have low affinity for cellulose. They are dyed at room temperature (20 - 30°C) with a small amount of caustic soda. Addition of salt is required for complete exhaustion of the dye.

IW dyes have a much higher affinity for cellulose and are dyed at 45 - 50°C with somewhat more caustic soda and less salt. Regenerated cellulose and mercerized cotton are dyed without salt.

IN dyes require still more caustic soda and are dyed at 60°C. Addition of salt is not required since the dye bath is sufficiently exhausted even in deep shades. It may be necessary to use some retarding and levelling agents, so that the rate of dyeing is reduced or controlled so that the dyeing is uniform.

IN special comprises only a few dyestuffs. These are dyed at 60 - 80°C (80°C for blacks). The caustic soda additions are higher than for IN class. Because of their high affinity, salt addition is not required.

All dyestuff manufacturers provide information in dyestuff shade card related to chemical requirements for vatting and dyeing. The applicable procedures are also precisely given and should therefore be carefully studied.

10.8.2 Reactive Dyes

Reactive dyes were first developed in 1956 by I.C.I., U.K. As the name implies, the dye is retained by means of a chemical reaction between the dye and the fibre. The fibres most readily coloured with reactive dyes are natural and man-made cellulosic fibres, natural protein fibres and polyamide (Nylon 66, Nylon 6) fibres.
For cellulosic fibres the dyeing process consists of three stages:

- Exhaustion from an aqueous bath containing common salt primarily under neutral conditions,
- Addition of an alkali to promote further uptake and chemical reaction of absorbed dye with the fibre,
- Dyed material is then rinsed and soaped to remove electrolyte, alkali and unfixed dye.

With some reactive dyes, the dyeing can be carried out at room temperature. However, with most reactive dyes, the temperature of the dye bath must be increased (in some cases to the boil), to effect the reaction between the dye and the fibre.

Reactive dyes are applied to protein fibres under slightly acidic conditions. They are also used to dye nylon fibres - again under acidic conditions. In both cases, an increase in temperature assists the exhaustion of the dye.

10.8.3 Direct dyes

The fibres most readily coloured with direct dyes, which are anionic in nature, are cotton and viscose rayon fibres. The dyes are applied from an aqueous dye bath containing an electrolyte (common salt). Though the dyes are easy to apply, they have low wash fastness; even when subjected to after-treatment subsequent to dyeing and do not meet the stringent requirements expected from cellulose apparel finishing materials. Also due to German ban (effective from 1996) on certain azo dyes, many direct dyes based on azo structure are banned. For these two reasons direct dyes have been replaced to a great extent by reactive dyes. The temperature of the dye bath may vary from room temperature to the boiling temperature of water. These dyes are generally recommended for those textile products which are not subjected to very frequent washing.

10.8.4 Basic Dyes

Basic dyes, also known as cationic dyes, are distinguished from the other classes of dyes by their brilliance of colour. They are extensively used for colouring acrylic and modacrylic fibres for which they have good affinity and exhaust well within narrow limits of temperature. When acrylic fibres first began to be marketed, they were very difficult to dye due to lack of specific dye sites in the fibre and to the strong dipolar bonding between the molecules that severely limited dye diffusion into the fibre. Through copolymerization, using ionic comonomers, these problems were overcome.

The most commonly used dyeing processes for acrylics are stock, package, skein, and piece dyeing. In stock dyeing, the fibre is dyed in staple form prior to yarn spinning. This method allows better penetration of dye into the fibre and a more even colour to be obtained. However, it is a more expensive process and is used for better quality and more expensive fibres.

In package dyeing, the yarn is wound onto cones and the dye liquor is forced around the outside of the package and into the centre of the cone. Complete penetration of the package is necessary to achieve uniform dye uptake.
A considerable amount of dyeing is by taking the yarn in the form of a skein or a hank which is allowed to hang freely during the dyeing.

The cheapest and perhaps the most common form of colour application is piece dyeing or dyeing of fabrics. The manufacturer is able to dye fabrics as per demand and not on the basis of projected demand.

Basic dyes are also used to a limited extent to dye silk and wool fabrics in which the cations are absorbed on the anionic groups present in these fibres. To give brilliant colours to polyester fibres, cationic dyeable fibres are produced using appropriate commoners so that they can be dyed with basic dyes. While basic dyes have little or no affinity for cotton and rayon, they give strong, bright colours on jute. However, in this case, colour fastness to sunlight is very poor.

10.8.5 Acid dyes

Acid dyes are usually applied under acidic conditions. They are used to dye natural protein fibres (silk, wool) and to a less extent nylon, acrylic and cellulose acetate fibres. They are relatively cheap and have good colour fastness to sunlight. However, after a number of washes, their fastness properly is affected.

10.8.6 Azoic colours

The main advantages of azoic colour are that dark blue, black, orange and red shades can be obtained economically. The dyeing is highly reproducible and in general the fastness proportions are good. This dye is most suitable for cold-dyeing techniques such as batik, tie-and-dye, etc.

The azoic colours on cotton are applied in two stages. The first consists of treatment with naphthol and the second by treatment of naphtholated material with diazotized base or diazotized salt. The colour development takes place in-situ on the material by the coupling reaction between naphthol and diazo component. After-treatment is essential for satisfactory fastness.

10.8.7 Disperse dyes

The fibres that are most commonly dyed with disperse dyes are cellulose diacetate, cellulose triacetate and polyester fibres. To a lesser extent acrylic and nylon fibres are also dyed with this class of dye.

Polyester fibres being hydrophobic and semi-crystalline, the assistance of high temperature, high pressure and carriers (which swell the fibre) is taken to achieve satisfactory dyeing.

10.8.8 Sulphur dyes

These dyes contain sulphur and are used to dye cellulosic fibres—both natural and man-made.
7. Match the following:
   i) Solubilised vat dye     a) Low wash fastness
   ii) After-treatment       b) Covalent bonding
   iii) Retarding agent      c) Brilliant colours
   iv) Basic dye             d) Cotton fibre
   v) Reactive dye           e) Auxiliary
   vi) Direct dye            f) Fixing the dye

8. State whether the following statements are True / False.
   i) Disperse dye is soluble in water True / False
   ii) Reactive dye forms a covalent bond with the fibre True / False
   iii) Basic dye is also known as anionic dye True / False
   iv) Bigger the dye molecule, better the fastness property True / False
   v) Direct dyes have excellent fastness properties True / False

10.9 Assignments

10.9.1 Class assignments
   i) Bleach a grey cotton fabric.

10.9.2 Home assignments
   i) Wash the cotton fabrics dyed with reactive dye and direct dye in hot water. Comment on their wash fastness.

10.10 Summing Up

   The lesson is in two parts. The first part deals with preparatory processes like singeing, desizing, scouring, bleaching and mercerizing. In the second part the dyes used for colouring fibres and the process of dyeing are considered. A variety of fibres require a variety of dyes. It is important that the dye remains inside the fibre and does not come out easily.
10.11 Possible Answers to Self-check Questions

1. Natural impurities: oils, fat, waxes, pectin and natural colouring matter; Added impurities: coning oil, size, and lubricant. In addition they pickup husk, dust, soil, kitties (small pieces of cut seed) and other vegetable matter during growth / collection.

2. Woven cotton fabric is passed at great speed through a naked gas flame to remove surface fibres / hairs. This process is known as singeing.

3. Desizing is the removal of the sizes which are applied to the warp yarns of the woven fabrics before weaving.

4. Milling is the process of deliberately felting the woollen goods to achieve an entangled web of fibres.

5. Bleaching is a process which makes the fabric white by removing the natural colouring matter present in the fibres.


7. (i) d  (ii) f  (iii) e  (iv) c  (v) b  (vi) a

8. i) False   ii) True   iii) False   vi) True   v) False

10.12 Terminal Questions

1. Why is it necessary to dye textile materials?

2. Why can you not dye all the textile materials using a single dye?

3. For a dye-fibre system of your choice, describe what will be the typical dyeing process?

4. Explain different types of bleaching agents and their importance.

5. Describe the process of mercerization.

6. At high temperatures, dyeing is generally faster, why?

7. Polyester fibre is difficult to dye. Why?

10.13 References


10.14 Suggested Further Reading


10.15 Glossary

1. Affinity  
   Mutual attraction

2. Exhaustion  
   Consumed, use up

3. Material to liquor ratio  
   The ratio of the weight of the material to the volume of the liquor