Learning Objectives

The learning objectives of this unit are to list the machines used in dyeing.

4.1 Dyeing machines

Objectives of Dyeing machines:

Dyeing machines provide maximum contact between the dye liquor and the fibers within a reasonable amount of time, without causing damage to the substrates. They increase the rate of production. They reduce the dyeing cost, labour cost, reduce the consumption of water, steam and chemicals and facilitate the dyeing of the material in package form.

4.2 Stock Dyeing
Important Features

It is an expensive method of dyeing. 10-15% waste of dyed fibers during yarn spinning. It allows excellent penetration of dye into the fiber.
**Fashion risk** – The final colour of the fabric has to be desired at the earliest stage in its manufacture.

**Reason for use:** It is used to create a Heather-like effect’ for woolen yarns, or to produce “Melange yarns”.

### 4.3 Yarn Dyeing

The dyeing of yarns before they have been woven or knitted into fabrics is known as yarn dyeing. Yarn may be dyed in different forms: Skein, Package and Beam.

**Important Features:**

Yarn dyeing is cheaper than stock dyeing. It allows excellent colour penetrations of dye into the fiber than piece dyeing.

**Reasons for Use:**

It is used to produce stripes, plaids and checks and other multi colored designs.

### 4.4 Skein Dyeing

In the Skein dyeing technique, large loosely wound hanks (skeins) of yarn is immersed into dye vats. It is suitable for knits and carpets where a fuller bulk is more desirable. Cotton, woolen, silk and bulk acrylic yarns can be dyed.
4.5 Package Dyeing

In this method, yarns are dyed in package form. The yarns are rewound from paper cops/bobbins, onto plastic/metallique cops/bobbins which has perorations. These yarn packages are mounted on perforated rods and then loaded into the dye machines. After loading, the carrier is dropped into a seating in the dyeing tank, through which the dye-liquor is circulated thoroughly. Here, the yarn package is stationary and dye liquor is circulated through the package.

**Important Features**

The yarn package prepared are soft wound with low winding tension to ensure uniform dyeing. Yarns used for such dyeing are imparted lower twist for better dye penetration. These dyed yarns can be used to prepare both woven and knitted fabrics. High pressure dyeing can be carried out by this method. Dyeing can be performed on a larger scale and the package dyeing imparts uniform dyeing.
4.6 Beam Dyeing

Beam dyeing is a larger version of package dyeing. Yarns or full width of woven or knitted fabric is wound on to perforated cylindrical beams and enclosed in a container. As in package dying, the dye liquor is circulated under pressure through perforation. Warp yarns are dyed in a solid colour prior to weaving / warp knitting. It provides for good color absorption, and it has better color fastness than piece dyed methods.
4.7 Piece Dyeing

Piece dyeing is carried out in the fabric stage, generally to produce single solid color in the substrate.

4.8 Winch Dyeing / Beck Dyeing

The winch machine is a conventional dyeing machine. It consists of a tub containing the dye liquor, and an elliptical winch which is located horizontally above the dye bath. The ends of the fabric are stitched together to convert it to a continuous rope form which is passed through the dye bath and submerged repeatedly. The fabric is held in a slack or loose condition during dyeing. Dyeing is carried out at high liquor ratios. (1:20 to 1:50)
Low substantivity dyes for example, reactive dyes are not advisable. Winch dyeing or beck dyeing is mainly used for knits and lightweight fabrics. The filament yarn fabrics that tend to break should not be dyed. It is difficult to maintain uniform temperature throughout the dye bath. Further, fabrics tend to crease a lot.
4.9 The Jigger Dyeing Machine

The Jigger dyeing machine consists of a small tub and two drawing rollers located above the dye bath. First the fabric is wound around one of the rollers known as let-off rollers. During the process of dyeing the fabric is passed through the dye bath and rewound on to the second roller known as take-up roller. When all the fabric is passed through the dye bath the direction of movement is reversed. This would be repeated for a number of cycles until the dyeing is completed. In this machine, dyeing tension is imparted across the length of the fabric during the process of dyeing.

This machine is suitable for light and medium weight fabrics. Dyeing is carried out at low liquor ratios (1:2 to 1:6). The consumption of chemicals and energy is low. The new jiggers are equipped with devices that allow a reduction in tension applied in lengthwise direction. Knitted and stretch woven fabrics cannot be dyed in this machine. There is the possibility of shade variation center to selvedge.
4.10 The Jet Dyeing Machine

The Jet dyeing machine enables a very efficient contact between the dye liquor and fabric to be obtained. The fabric and liquor are in constant movement. This results in improved level of dyeing and shorter dyeing time. The fabric is circulated through the dye bath in rope form. The movement of the fabric occurs by circulating the dye-liquor through a venturi jet. The venture jet develops high pressure which further facilitates uniform movement of material and liquor. Jet dyeing machines are pressurized, and dyeing can takes place at high temperature 135-150°C. Jets are built to be used at low liquor ratios between 10:1 and 5:1 and lower.

Advantages:
The Jet dyeing machines use less water, chemicals and energy. They have a shorter dyeing time. They are efficient and enable high production. They can be used to dye delicate wovens, knits, textured and lightweight fabrics.
Garment dyeing refers to dyeing of completed garments. This process can only be used for garments under on-tailored categories, such as sweaters, sweatshirts, hosiery and pantyhose. Tailored items like suits or dresses cannot be dyed as garments. The difference in shrinkage of the various components can distort and misshape the article.

Garment dyeing is done by, placing suitable number of garments (usually 24 sweaters or equivalent) into a large nylon net bag. Such loosely packed 10-50 bags are then placed in large dye bath and kept and agitated by a motor driven paddle. This machine is called a "Paddle dyer".

**Important Features**

There is less fashion risk, as the material need not be dyed until shortly before the actual sale of the merchandise. Based on the buyer order, a manufacturer can offer wider varieties of colours. It provides quick response and rapid delivery for small orders. All the fabric used in one garment must come from the same lot of fabric.

**Fabric** must be tested for shrinkage before cutting the garments, and must be given required tolerance to allow for shrinkage so that size will be accurate.

**Threads** must be selected carefully and tested to ensure that it will accept the dye in the same way as the fabric.

**Labels, buttons and zippers** must be compatible with the garment fabric in terms of reaction to the dye and shrinkage.
4.12 Cross Dyeing

In the cross dyeing technique, Yarn, fabric or even garment made with two or more generic fiber types having different dyeing qualities is dyed in a single dye bath containing two different classes of dyes.

When different fibers are blended in the same yarn a Heather-like effect is obtained. Different fiber content yarns used in a fabric construction can obtain plaids, stripes and checks.
4.13 Union Dyeing

This technique is used to achieve single solid colour in blended fabrics. In the Union dyeing technique, a fabric composed of rayon and acetate can be dyed in solid color of green by using a direct dye for the rayon and “disperse dye” of the same color for the acetate.

4.14 Conclusion

To summarize, in this unit, you have learnt about stock dyeing, various types of yarn dyeing such as Skein dyeing, Package dyeing, Beam dyeing, various types of Piece dyeing, such as Winch or Beck dyeing. You have also learnt about the Jigger dyeing and the Jet dyeing machines used to dye fabrics as well as Garment dyeing.