KRISHNENDU DAS

SEMESTER – IV

SKILL ENHANCEMENT COURSE

SERI – TEXTILE TECHNOLOGY (Unit -2)

Silk Dyeing Process

Silk Dyeing:

Silk being a natural polyamide or polypeptide fibre, its dyeing properties are very similar to those of other natural polypeptide fibre, wool as well as synthetic polyamide fiber, nylon. They can be dyed by similar methods. Very fine fibrillar structure and high orientation of fibre molecules are the two characteristic properties of silk which determine its dyeing behaviour.

Silk is comparatively easier to dye and is less sensitive to temperature. However, there is always a risk of damage of silk filaments during dyeing and the dyeing on the damaged material may apparently look like faulty dyeing.

Silk Dyeing Process

Since **silk fiber** has a slightly cationic character with the isoelectric point at about pH 5.0, . So silk is dyed using various dyes such as Acid dyes, metal-complex, reactive dyes etc. Acid dyes are more suitable for silk and wool. Dyeing and printing makes it possible to

bring about the choicest colours and shades on silk leading to value addition of the silk materials. Silk offers a wide colouration possibility covering almost the entire spectrum of colours and hues due to its ready acceptability for a large range of dyestuffs.

For dyeing with milling, supermilling acid dyes and 1:2 metal-complex dye, the recipe (% o.w.m.) is:

x % dye
0.5-1.5% Lyogen MF or SU liquid
1-2% Imacol S liquid,
1-2 g/l sodium acetate and acetic acid for pH 4.5-7, depending on depth.
The chemicals are added in the bath at 20-30ºC and then the dissolved dyes are added slowly or in instalments. The temperature is raised slowly to the ambient temperature of 60-70ºC or 80-90ºC depending on the material and the dyeing is continued for 60 and 45 minutes for the respective temperature ranges.

For dyeing in soaping bath:

- x% dye
- 1-2 g/l Marseilles soap
- 5-20% Glauber's salt
- pH 8.0-8.5

The wet fastness of silk dyed with acid and metal-complex dyes may be improved by aftertreating with a cationic product such as Sandofix WE (Clariant) or stronger fixing agents like Indosol E-50 or Lanasan MW (Clariant).

Silk may be dyed by pad-batch method with Drimalan F or Drimarene K dyes by padding the material at room temperature with a liquor containing:

- x% dye
- 50-100 g/l urea (solubilising agent)
- 10-20 g/l sodium bicarbonate
- 0-2 g/l wetting agent, e.g. Sandozin AMP

The padded material is batched for 24 hours. Adequate colour yield and fixation may not be achieved with certain large-molecular dyes such as turquoise and green types.

Conclusion:

Both wool and silk are costly and delicate fibres. Under adverse conditions, they are damaged severely. High alkalinity and high temperature are harmful for these fibres. Apart from stiffening of fibres during dyeing, wool may be felted into an entangled mass, while silk filaments may be broken or chafed. Both the fibres are rich in active chemical groups. A number of dye-classes are available which can provide bright and deep shades of moderate to high fastness properties. As these materials are delicate and are handled very carefully, fastness requirements are not very high. The dyed material should possess satisfactory fastness meeting washing ISO.

Types

Acid dyes are water-soluble anionic dyes that are applied to fibers such as silk, wool, nylon and modified acrylic fibers using neutral to acid dye baths. Attachment to the fiber is attributed, at least partly, to salt formation between anionic groups in the dyes and cationic groups in the fiber. Acid dyes are not substantive to cellulosic fibers. Most synthetic food colors fall in this category. Examples of acid dye are Alizarine Pure Blue B, Acid red 88, etc.

Basic dyes are water-soluble cationic dyes that are mainly applied to acrylic fibers, but find some use for wool and silk. Usually acetic acid is added to the dye bath to help the uptake of the dye onto the fiber. Basic dyes are also used in the coloration of paper.

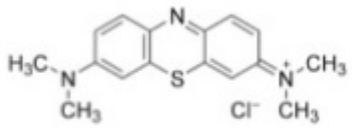
Some dyes commonly used in Staining:

Basic Dyes	Acidic Dyes
Safranin	Eosin
Basic Fuchsin	Acid Fuchsin
Crystal violet	Congo Red
Methylene Blue	

BASIC DYES

Basic dyes are water soluble cationic dyes .

- ❑ These dyes consist of amino groups (trialkyl amines , dialkyl amines) and are usually aniline dyes .
- ❑Basic dyes produce bright shades on textile materials .
- ❑ Eg. Methylene Blue



PROPERTIES OF BASIC DYES

- Ionic Nature : cationic
- Shade range :unlimited shade range with high tinctorial value , brightness
- Solubility : soluble in water
- Leveling Properties : poor leveling
- Affinity : very affinity towards wool , silk and acrylic fibre
- Fastness Properties : light fastness is poor but wet fastness is good

- APPLICATIONS :

❑ These dyes are applied to wool , silk and acrylic fibre , usually acetic acid is added to dyebath to help the take up of the dye onto the fibre .

❑ These dyes are also used in colouration of paper

Acid Dye

An **acid dye** is a dye that is typically applied to a textile at low pH. They are mainly used to dye wool, not cotton fabrics.[1] Some acid dyes are used as food colorants,[2][3] and some can also be used to stain organelles in the medical field.

Description

Acid dyes are generally divided into three classes according to their fastness requirements, migration ability, and dyeing pH.

Acid dyes affix to fibers by hydrogen bonding, Van der Waals forces[5] and ionic bonding. While some acid dyes work in water, many choose to activate dyes in acid dye-baths instead. According to the Brønsted–Lowry acid–base theory, an acid is a molecule or ion capable of donating a proton, and this is determined by the acid dissociation constant. Compared to most acids, water has a much higher pKa value, meaning that it dissociates to give H^+ with more difficulty. In this context, if an acid is used instead of water, then the hydrogen ion (H^+) is more easily able to dissociate in order to react with the aniline dye anion, allowing the dye to dissolve.

Animal protein fibers and the synthetic fiber nylon contain many cationic sites that bind anionic dye. The strength (fastness) of this bond reflects the strength of this ionic interaction.

Uses

Fibers

In the laboratory, home, or art studio, the acid used in the dye-bath is often vinegar (acetic acid) or citric acid. The uptake rate of the dye is controlled with the use of sodium chloride. In textiles, acid dyes are effective on protein fibers, i.e. animal hair fibers like wool, alpaca, and mohair. They are also effective on silk.[6] They are effective in dyeing the synthetic fiber nylon, but of minimum interest in dyeing any other synthetic fibers.

Medicine

In staining during microscopic examination for diagnosis or research, acid dyes are used to color basic tissue proteins. In contrast, basic dyes are used to stain cell nuclei and some other acidic components of tissues. Regarding cellular structures, acid dyes will stain acidophillic structures that have a net positive charge due to the fact that they have a negatively charged chromophore. Acidophillic structures include the cytoplasm, collagen and mitochondria. The two have an affinity for each other due to the conflicting charges. Examples of acid dyes used in medicine include:

- Lee's stain (stains reddish-pink).
- Phosphotungstic Acid Hematoxylin (PTAH) stain (stains blue).
- Eosin stain (stains pinkish-orange).

Food Industry

Acid dyes can also be used as food colouring, helping to increase the attractiveness of certain foods, and thus becoming more appealing to customers. Some examples include erythrosine, tartrazine, sunset yellow and allura red, to name a few, many of which are azodyes.These dyes can be used in frosting, cookies, bread, condiments or drinks. In order to prevent health hazards, a dye must be approved for consumption before it can be marked as edible. Some separation methods that can be used to identify unapproved dyes include the solid phase extraction process, the overpressured thin layer chromatography process, and the use of reversed-phase plates.

Structures

The chemistry of acid dyes is complex and diverse. Most acid dyes are related in basic structure to the following:

- **Anthraquinone type:** Many acid dyes are synthesized from chemical intermediates that form anthraquinone-like structures as their final state. Many blue dyes have this structure as their basic shape. The structure predominates in the leveling class of acid dye.
- **Azo dyes:** The structure of azo dyes contains the azo group (R-N=N–R. Most azo dyes are not acid dyes, but many acid dyes are azo dyes. Many acid dyes of the azo type are red in color.[13]
- **Triarylmethane dye:** These predominate in the milling class of dye. There are many yellow and green dyes commercially applied to fibers that are related to triphenylmethane.

Classes of acid dyes

Acidic dyes can be classified accoding to their dyeing behaviour. This includes their wet fastness, migration ability, and dyeing pH.

- **Leveling acid dyes:** These dyes have relatively low molecular weights. Consequently they bmigrate more readily before fixation and they exhibit low wet fastness. They are not normally suited for use as apparel fabric. They require an acidic dyebath, often using sulfuric acid and sodium sulfate mixtures (pH2-4), together with leveling agents such as ethoxylated fatty amines.

- **Milling dyes:** These dyes arre high molecule weight, with the result that migrate slowly. Consequently they exhibit wet fastness, which is useful for dyeing wool materials. Milling acid dyes are sometimes called 'Neutral acid dyes' as they do not require an acidic dyebath. They are commonly applied using Acetic acid (pH4-7).

- **Metal complex acid dyes:** These dyes are composed of acid dye molecules complexed with a metal ion, which will usually be chromium or cobalt. Metal complex acid dyes have high molecular weightss, giving them low mobility and the high wet fastness. Due to this, they are commonly used on nylon and synthetic poly-amide fibers. Metal complex acid dyes are economical, however they produce relatively dull shades. Metal complex acid dyes take a larger range of pH in the dyebath (pH2-7).

Safety

Some dyes are mutagenic and carcinogenic, including methyl orange, acid red 26, and trypan blue.