# Preparation of Cloth for dyeing

# METHODOLOGY

- PREPARATION OF CLOTH FOR DYEING
- Grey cloth as it comes from the loom stage is unattractive and contains natural as well as added impurities, which hinders the successful operations of dyeing by reducing the absorbency of the fabric that's why it is necessary to make the fabric water absorbent, by making the fabric free from any natural as well as added impurities in order to achieve successful dyeing process.
- Preparation of the cotton cloth contains following steps systematically.

# Different Treatments to the fabric

- Desizing
- Scouring
- Bleaching

# Desizing

- Desizing is a process by which fatty matters are removed from the grey cloth i.e. starch etc., which applied to the warp and weft yarns during weaving in order to with stand the stress or strain.

- Process of desizing can be done either by hydrolytic desizing or by oxidative desizing.

- The theme of desizing process is only to convert the insoluble starch into soluble form. Starch can be hydrolyzed under the following steps:

- Starch → Dextrin → Dextrin → Maltose → Glucose

- (Insoluble) (Insoluble) (Soluble) (Soluble) (Soluble)

# Scouring

- Scouring is the process by which oils, fats, waxes and other nitrogenous matters are removed. Process is carried out by adding 2g/l caustic soda, 1g/l soda ash and 1 g/l T.R.O. and then the temperature is raised to boil and process continued for 3-4 hours under the pH 10-11.5.

# Bleaching

- A method of bleaching, the fabric is rinsed and struck against a stone, so as to remove as much of the sizing as possible. It is then spread out for sun bleaching and drying, water is sprinkled over the cloth at short intervals until evening. Then it is finally washed and dried.

# TREATMENT OF FABRIC BEFORE DYEING

- After removing the impurity of fabric then it is treated with 4% (owf) solution of tannic acid in water. The fabric should be dipped in tannic acid solution for at least 4-5 hours. It is squeezed and dried. After mordanting this fabric is used for dyeing and dyeing would depend upon the type of mordanting that has to be subsequently carried on.For our study only pre mordanting was carried out

- Pre mordanting

- Post mordanting

- Simultaneous mordanting

- Pre mordanting

- Fabric which is already treated with tannic acid dipped is in 4% mordant solution and kept on water bath at 50°C for one hour. It is squeezed and dried.

# Sonicator dyeing

For dyeing sonicator has been used as dye bath. Extracted dye is kept in sonicator and treated fabric is dipped in it for one hour.

After one hour it is dried in shade.

Dye uptake by the fabric is monitored by the towering of optical density of the dye bath solution and also by the shade of the color that appears on the fabric.

The tone can be adjusted as per the requirement. Dyed fabric is dipped in sodium chloride solution for one hour and then fabric is washed with tape water and dried it in Shade.

# Steps involved in Dyeing

- ***Multistep in dyeing***
- Change in dyeing process can result into better dye uptake in case of bio-mordant and enzyme. The process can be defined as one step dyeing and two step dyeing process (conventional dyeing).

- ***One step dyeing process***
- In one step dyeing process, dyeing is carried out with Mordanting, i.e., simultaneous dyeing with pretreatment.

# Steps in dyeing

- ***Two step dyeing***
- In two step dyeing process first mordanting is carried out by enzyme or bio-mordant and then dyeing is done.

- Both the process produce different results and sometimes one step dyeing gave very good results.
- A revived interest in the use of natural dyes in textile coloration has been growing and there is a growing need for the availability of natural dye yielding plants. Thus there is strict need to explore our flora and fauna for high dye yielding plants to get new hues and shades in fabric to suit fashion conscience new age customer's demand.

# Role of enzyme as mordants

Basically Enzymes are "biological catalysts". "Biological" means the substance in question is produced or is derived from some living organism and "Catalyst" denotes a substance that has the ability to increase the rate of a chemical reaction, and is not changed or destroyed by the chemical reaction that it accelerates. Generally speaking, catalysts are specific in nature as to the type of reaction they can catalyze.

Enzymes, as a subclass of catalysts, are very specific in nature. Each enzyme can act to catalyze only very selected chemical reactions and only with very selected substances.

# Enzymes

Now a days, Enzymes are gaining an increasing role in textile wet processing due to their proven flexibility, reliability and concern about safety, energy and water conservation and environmental responsibility.
Enzyme can be used in chemical as well as bio chemical process as they are the most efficient under normal conditions of temperature, pressure and pH.
Enzymes are very specific with their action and they show results in reasonably good time and in a very cost effective manner. Enzymes are of bio-origin thus making the process eco-friendly.

# Types of enzymes

Amylases, proteases, lipase, cellulase, Beta-glucanase (or gumase), Pectinase and trypsin are the common enzymes with various functions in biological systems and industrial uses and some of which can also be proposed to use as mordants in the natural dyeing process among these cellulose ,protease and trypsin have been taken for the study with Natural dyeing.

# Cellulases

- Cellulase (of various types) breaks down the complex molecule of cellulose into more digestible components of single and multiple sugars. Cellulase refers to a group of enzymes which, acting together, hydrolyze cellulose.

- Cellulose is a linear polysaccharide of glucose residues connected by β-1,4 linkages. Like chitin it is not cross-linked. Native crystalline cellulose is insoluble and occurs as fibers of densely packed, hydrogen bonded, anhydroglucose chains of 15 to 10,000 glucose units.

# Cellulases

- Its density and complexity make it very resistant to hydrolysis without preliminary chemical or mechanical degradation or swelling. In nature cellulose is usually associated with other polysaccharides such as xylan or lignin. It is the skeletal basis of plant cell walls.

- Cellulase enzyme have gained industrial acceptance for finishing of cellulosic fabric to achieve a variety of effects including enhancement of fabric surface appearance and softening of denim garments without or with low environmental impacts . Enzymatic treatments are usually performed prior or subsequent to dyeing and finishing processes .

# Proteases

- Protease refers to a group of enzymes whose catalytic function is to hydrolyze (breakdown) proteins. They are also called proteolytic enzymes or proteinases.

- Proteases can either break specific peptide bonds (*limited proteolysis*), depending on the amino acid sequence of a protein, or break down a complete peptide to amino acids (*unlimited proteolysis*).

- The activity can be a destructive change, abolishing a protein's function or digesting it to its principal components; it can be an activation of a function, or it can be a signal in a signaling pathway.

# Proteases

- The process is called *proteolytic cleavage*, a common mechanism of activation or inactivation of enzymes especially involved in blood coagulation or digestion.

- They use a molecule of water for this and are thus classified as hydrolases. Proteases, (or proteinase), which split up proteins into their component amino acid building blocks.

- Proteolytic enzymes are very important as they breakdown the peptide bonds in the protein to liberate the amino acids. Additionally, proteolytic enzymes have been used for a long time in various forms of therapy.

# Trypsin

Trypsin enzyme that acts to degrade protein ; it is often referred to as a proteolytic enzyme, or proteinase. Trypsin is one of the three principal digestive proteinases, the other two being pepsin and chymotrypsin .

In the digestive process, trypsin acts with the other proteinases to break down dietary protein molecules to their component peptides and amino acids. Both enzymes also appear to have similar mechanisms of action; residues of histidine and serine are found in the active sites of both.

The chief difference between the two molecules seems to be in their specificity, that is, each is active only against the peptide bonds in protein molecules that have carboxyl groups donated by certain amino acids.

# Trypsins

- For trypsin these amino acids are arginine and lysine, for chymotrypsin they are tyrosine, phenylalanine, tryptophan, methionine, and leucine. Trypsin is the most discriminating of all the proteolytic enzymes in terms of the restricted number of chemical bonds that it will attack

- Trypsin cleaves peptide chains mainly at the carboxyl side of the amino acids lysine or arginine, except when either is followed by proline. It is used for numerous biotechnological processes. The process is commonly referred to as trypsin proteolysis or trypsinisation, and proteins that have been digested/treated with trypsin are said to have been trypsinized.

# Role of plants as bio mordants

A bio-mordant can be defined as a natural material having one or more metal ion in it which can act as mordant. The special thing about this material is that they are always obtained biologically, i.e., they may come from vegetative matter. The presence of metal species combines with fabric in same way as synthetic metal salt species and form complex with dye to give stability in terms of color fastness to fabric. The research in the field of bio-mordants is currently ongoing on fast pace as this could change the picture of dyeing process in a big way. Various studies have been done with plants or plant parts as potential Bio-mordants. Two indigenous plants, *Pyrus pashia* and *Eurya acuminata* which were easily available in north east region of India, were analyzed for their potential as Bio- mordants.

- ***Pyrus pashia and Eurya acuminata***

# Presence of metal ( Cu ) content in pyrus to be mentioned

***Pyrus pashia***

# Presence of metal ( Al ) content in Eurya to be mentioned

**Eurya acuminata**

# Other Biomordants used are

- Gall nut (Majuphal) *Quercus infectoria*
- Myroblan (Harda) *Terminalia chebula*
- Tannins
- Tannic acid

# Parameters for Dyeing

- Rate of Dyeing/ Kinetics of Dyeing
- Enthalpy of Dyeing
- Entropy of Dyeing
- Adsorption Isotherm
- Dye affinity
- Dye uptake