

TC HLM 02

HAND DYEING OPERATOR



Developed by Textiles Committee, Resource Support Agency, for exclusive distribution and use for trainees under Integrated Skill Development Scheme of Ministry of Textiles, Government of India



**Textiles Committee  
Government of India,  
Ministry of Textiles**



**COURSE MATERIAL UNDER  
ISDS FOR  
HAND DYEING OPERATOR**

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## 1. Basic wet Processing Terms

**ABSORBENCY:** The ability of textile material to take up water particle.

**BLEACHING:** Process to remove the natural and artificial impurities in fabrics to obtain clear whites for finished fabric or in preparation for dyeing and finishing.

**DEFECTS:** A general term that refers to some flaw in a textile product that detracts from either performance or appearance properties.

**DYEING:** A process of coloring fibers, yarns, or fabrics with either natural or synthetic dyes.

**DYES:** Substances that add color to textiles.

**FINISHING SPOT:** A discolored area on a fabric caused by foreign material such as dirt, grease, or rust.

**LUSTER:** The quality of shining with reflected light.

**MATERIAL TO LIQUOR RATIO:** This expression refers to the weight : volume relationship between the textile material (Fibre, yarn or fabric etc.,) to be dyed and total volume of dye bath . An M:L ratio of 1:10 means that a dye bath volume of 10 litres is required to dye 1kg of textile material.

**MERCERIZATION:** A treatment of cotton yarn or fabric to increase its luster and affinity for dyes. The material is immersed under tension in a cold sodium hydroxide (caustic soda) solution.

**MIGRATION:** Movement of dye from one area of dyed fabric to another.

**SATURATION:** The maximum intensity or purity of a color.

**SELVEDGE:** The narrow edge of woven fabric that runs parallel to the warp. It is made with stronger yarns in a tighter construction than the body of the fabric to prevent raveling.

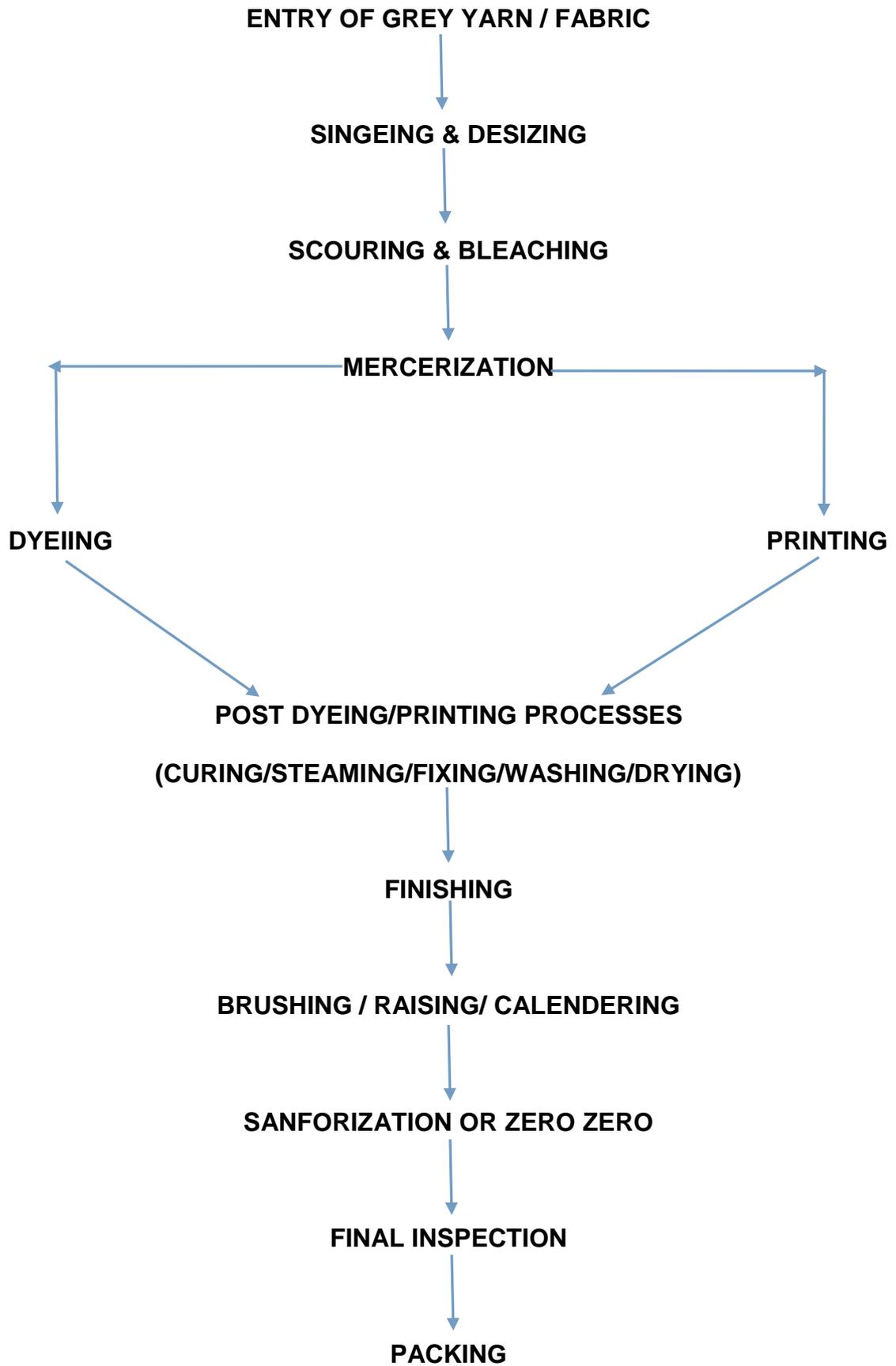
**SHADE PERCENTAGE:** Shade percentage refers to the quantity of dye taken for dyeing expressed as a percentage of the dry weight of textile material to be dyed. For Example, if 1gm of dye is taken for dyeing 100 Gms of textile material, the shade percentage is referred to as 1% shade.

**PADDING:** The application of a liquor or paste to textiles either by passing the material through a bath and subsequently through squeeze rollers.

**pH:** Value indicating the acidity or alkalinity of a material.

**SOFTENER:** A product designed to impart a soft mellowness to the fabric.

## 2. Sequence of operations in wet processing



### 3. Brief note on Hand Dyeing:

Dyeing is the process of adding color to textile products like fibers, yarns, and fabrics. Dyeing is normally done in a special solution containing dyes and other chemicals. After dyeing, dye particles get fixed with the textiles material and unfixed dyes are removed from it by further washing. The temperature and time controlling are two key factors in dyeing.

There are mainly two classes of dyes one is natural and the other is man-made. Historically the primary source of dyes, has generally been from nature, with the dyes being extracted from animals or plants. Since the mid-18th century, humans have started producing artificial dyes to achieve a broader range of colors and to render the dyes more stable to resist washing and general use.

Hank yarn is dyed manually in tubs and vats, throughout the world even today. All the processes right from scouring to bleaching and dyeing, are being done in small vats. This trade is still vibrant as cottage industry in India, Sri Lanka, Bangladesh & some interior parts of Africa.

Hank Yarn is also dyed in power operated dyeing machines. In this type of dyeing also the chemistry of dyeing dose not change from that of manual dyeing. This type of machine dyeing is also prevalent in many countries



**Dyes**



**Dyed fibre**



**Undyed hanks**



**Dyed hanks**

### **The processing sequence for hand Dyeing is**

- Wetting or soaking the material,
- Desizing,
- scouring,
- bleaching,
- neutralization,
- dyeing,
- finishing and drying.

Various processes in hand dyeing are explained from an operator point of view.

Note: In all the following pretreatments and dyeing methods the details related to quantity of chemicals to be used, process parameters like temperature, P<sup>H</sup> & impregnation time etc., to be maintained are shown as general guideline and for indicative purpose only. Industry practice may vary slightly due to quality of water used, purity of chemicals added local environmental conditions and the customers requirement.

#### **Wetting:**

The greige cotton yarn does not have the tendency to absorb water, a natural coating of wax and oil over the surface of cotton prevents it from being wetted out. To wet the yarn uniformly, in a tub of water, a good wetting agent is added @ 0.5 to 1 gram/liter. The greige goods are soaked in this bath over night. This process improves the water absorbency. After soaking the yarn over night the wet yarn from the bath is taken out for further processes.



**During Pre-Treatment processes**

#### **4. Desizing**

Cotton material is Desized to remove the sizing material that is applied to the gray Yarn and to become free of the added matter for effective scouring and bleaching.

##### **Acid Desizing of cotton material:**

##### **Materials /Chemical Required**

Greige Cotton fabric/ Yarn, Hydrochloric Acid or sulphuric acid and Water

##### **Desizing Procedure:**

- Keep the Vat ready for making De sizing bath.
- Bring the material (quantity of material as instructed by supervisor) with correct identification to be desized near the Vat
- Use dilute sulphuric or hydrochloric acid as per the instructions of supervisor.
- Pour 2 % Hydrochloric Acid solution in the vat provided.
- Raise the temperature 40 °C or as instructed by supervisor
- Now Impregnate the goods (textile material –Yarn or fabric) for 1-2 hrs or as instructed in the above Vat and allow it to get processed.
- During impregnation the acid hydrolyses the starch present in the sized material and the size material will get dissolved in the vat.
- Drain the de sizing liquor from the vat after the allowed time of impregnation

- After draining wash the material as instructed with water until the acid and size materials are removed from it.
- After complete washing store the material for next process at the designated place

## **5.SCOURING:**

Cotton material is scoured to remove natural impurities like natural oils and waxes as well as added impurities.

### **Materials /Chemical Required**

Desized Cotton fabric or yarn, Sodium Hydroxide, Soda ash, Wetting Agent and Water.

### **Scouring Procedure of Cotton Material with Caustic Soda:**

- Keep the Vat ready for making Scouring bath
- Bring the cotton Yarn or fabric to scouring bath (quantity of material as instructed by supervisor) with correct identification to be Scoured
- Use alkaline liquor containing caustic soda, detergent, wetting agent, emulsifying agent as instructed by supervisor
- Pour the chemicals as instructed in the scouring bath.
- Raise the temperature of the scouring bath to boiling or as instructed by supervisor
- Now impregnate the cotton hank yarn or fabric in the scouring bath and allow it to get processed for 6-10 hours or as instructed.
- During this process of chemical reaction the impurities, oily and wax like substances dissolves.
- Drain the scouring liquor from the bath after the allowed time of impregnation
- After draining wash the material with hot water and then with cold water until the chemicals and oily/Wax like substances are removed from the material.
- After complete washing store the material for next process at the designated place

## 6.BLEACHING

Bleaching is a process to remove the natural colouring matters and other impurities in cotton Yarn / fabrics to obtain clear whiteness on the textile material as a preparation for dyeing and finishing.



Greige Hank yarn

Bleached Hank yarn

### Materials /Chemical Required:

- Scoured cotton fabric or hank yarn,
- Bleaching Powder,
- Sodium Hydroxide,
- Hydrochloric Acid and Water.

### Bleaching Procedure ( With calcium Hypochlorite):

- Take the correctly identified de sized and scoured Hank Yarn/fabric for bleaching
- Make the bath for bleaching ready
- Prepare the bath for bleaching with 10-30 gram per litre of calcium Hypochlorite or as instructed
- Maintain 1:20 material to Liquor ratio.

- Check the pH value of the bath
- Now correct the pH with the help of Caustic Soda
- Ensure to maintain the pH 11.
- Soak the cotton hank yarn / fabric in the bath for one hour at room temperature or as instructed.
- Keep turning the hank yarn / fabric once in every 10-15 minutes for one hour or as instructed.
- After the impregnation time drain the liquor from the bath after the allowed time of impregnation.
- After draining wash the material with cold water
- Now prepare a souring bath with 1 – 2 g/l of Hydrochloric Acid or as instructed for neutralization of pH and removal of hypochlorite.
- Soak the hank yarn / fabric in the souring bath for 5-10 min by turning the hank yarn / fabric periodically
- After souring wash the material with cold water.
- After complete washing, squeeze the material and store them for next process at designated place.

### **PEROXIDE BLEACHING OF COTTON MATERIAL:**

Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) is a universal bleaching agent capable of application in the bleaching with almost all textile fibres. Peroxide bleaching is carried out generally near or above boiling temperature, under pressure, for one hour or more.

#### **Materials /Chemical Required**

Scoured Cotton Hank Yarn / Fabric, Hydrogen Peroxide, Sodium Silicate, Caustic Soda and Water.

#### **Bleaching Procedure ( With Hydrogen Peroxide)**

- Ensure the availability of desized and scoured Hank Yarn / fabric with correct identification for bleaching
- Take the de sized and scoured material for bleaching
- Make the Vat ready for bleaching
- Prepare the bath for bleaching with following chemicals
  - i. Hydrogen Peroxide- 2%
  - ii. Caustic Soda – 2 %
  - iii. Sodium Silicate – 3%
- Maintain 1:30 Material to Liquor ratio.
- Enter the Hanks / fabric into the bath
- Soak the hanks / fabric in the bath
- Raise the temperature of the bath up to 90 degree centigrade.

- Maintain the temperature for 2 hours
- Keep turning the hank yarn /fabric frequently in the bath.
- After the process time drain the liquor from the bath and squeeze the material.
- Now wash the squeezed material with running water
- After complete washing and squeezing the Hanks / fabric, store them for next process at the designated place.

## 7. Dyeing of Cotton with Direct Dyes

### Materials /Chemical Required

- Bleached Cotton Hank Yarn / Fabric, Direct Dyes, Water, Sodium Chloride and Sodium Sulphate.
- Take the instructed quantity of de sized, scoured and bleached cotton yarn / fabric

### Preparation of stock Solution for dyeing the cotton hank yarn / fabric.

- As per supervisor's instructions weight the given dye stuff for the shade & colour to be dyed.
- Make a Paste of the dye stuff with the help of water
- Add small amount of hot water to the paste and dissolve it completely.
- If necessary heat the solution till it becomes clear
- Dilute the solution @ 200 ml /gram of dye stuff with cold water.
- This solution is called stock solution.

### Dyeing Procedure

- Take the weighted bleached cotton Hank yarn/ fabric with correct identification for dyeing
- Immerse the material in the water bath for 10 minutes.
- Add the prepared stock solution in to the water bath
- Maintain the material to liquor ratio 1:30.
- Slowly raise the temperature of water bath up to 90°C .
- Now turn the hank yarn / fabric every 5 to 10 minutes.
- Simultaneously stir the dye liquor continuously for 20 minutes.
- Now add the quantity of sodium chloride as instructed to the dye bath and increase the temperature up to boiling.
- Continue dyeing for 20 more minutes.
- At this stage add another quantity of sodium chloride as instructed to the dye bath.

- At the end of this process take the material out and squeeze them.
- After squeezing rinse the material with running water.
- Once the rinsing & squeezing is over soak the material in a bath containing 3 gram/liter soap solution and 2 gram/liter soda ash.
- After soaking again rinse the material in cold water.
- Subsequent to rinsing squeeze the material and take them for drying.



**Starting of dyeing operation**



**Hank Yarn Dyeing in progress**



**Squeezing operation**



**Drying in open air**

## 8. Dyeing of Cotton with Cold Brand Reactive Dyes

### Material/Chemical Required

- Bleached cotton hank Yarn / fabric, Water, Soda Ash, Sodium Chloride, Sodium Sulphate, Tri Sodium Phosphate.

### Preparation of the dye Solution for the cotton material to be dyed

- Weight the dye stuff as instructed for the shade & colour to be dyed.
- Make a Paste of the dye stuff with the help of water
- Add small amount of hot water to the paste and dissolve it completely.
- If necessary heat the solution till it becomes clear
- Dilute the solution @ 200 ml /gram of dye stuff with cold water.
- This solution is called stock solution.

### Dyeing Procedure

- Take the weighted bleached cotton Hank yarn / fabric with correct identification for dyeing
- Immerse the material in to a water bath for 10 minutes.
- Add the prepared stock solution to the water bath
- Maintain the material to liquor ratio 1:30.
- Slowly raise the temperature of water bath up to 40°C .
- Now keep turning the material for 10 minutes.
- Now add the amount of common salt or glauber salt as instructed and continue dyeing for 30 minutes
- Keep turning the materials frequently to obtain the even dying.
- After completion of the above process add soda ash as instructed and continue dyeing for 60 minutes.
- At the end of dying, take the material out and squeeze them and rinse with running water.
- Now soak the material in a water bath containing of 3gram/liters soap solution and 2gram/liters soda ash.
- The above soaking is done to remove undyed colours from the hanks.
- After soaking rinse the hanks in cold water and keep it for drying.

## 9. Dyeing of Cotton with Vat Dyes.

### Material/Chemical Required

- Bleached Cotton hank Yarn / fabric
- Sodium Hydroxide, Hydros,
- Wetting Agents (Terkey Red Oil) &
- Water and Hydrogen Peroxide .

### Preparation of Stock Solution

- Weight the dye stuff as instructed for the shade & colour to be dyed.
- Make a Paste of the dye stuff with Terkey Red Oil
- Add 2-3 grams per litre of NaOH (Dissolved in small water)
- Add 2-3 grams per litre of Hydro (Dissolved in water)
- Make the volume of solution as instructed.
- If necessary heat the solution up to 50°C
- Now the stock solution of 0.5% conc. is ready for dyeing

### Dyeing Procedure

- Take the weighted bleached cotton Hank yarn / fabric for dyeing.
- Enter them in a water bath and immerse them for 10 minutes
- Now prepare a dye bath with the stock solution and add water
- While adding water maintain the material to liquor ratio 1:30.
- Enter the bleached hank yarn / fabric in to the dye bath.
- Raise the temperature of the dye bath up to 40°C .
- Now keep turning the hank yarn / fabric for 4 minutes.
- Maintain the level of caustic & hydro in the water bath (2-3%)
- Take the material out & put them for oxidation.

### Oxidation

- Prepare an oxidation bath with 2% HCL & 3% H<sub>2</sub>O<sub>2</sub> solution
- Impregnate the dyed hank yarn / fabric in the oxidation bath & keep turning them for 5 min.

### Soaping

- Take the material from oxidation bath & run them in 2-3% soap solution for 20 min at 60°C.
- Once soaping is over take the material out and rinse them thoroughly with water

- After rinsing dry the material and store them at designated place.

## 10. Dyeing of Cotton with Sulphur Dyes.

### Material/Chemical Required

- Bleached Cotton Hank Yarn
  - Sulphur Dyes,
  - Turkey Red Oil,
  - Sodium Sulphide,
  - Soda Ash,
  - Common Salt/Sodium Sulphate,
  - Sulphuric Acid,
  - Potassium Dichromate,
  - Acetic Acid & Soap.
- Immerse it in water bath for 10 minutes.

### Preparation of Stock Solution:

#### Dissolving

- Weight the dye stuff as instructed for the shade & colour to be dyed.
- Make a Paste of the dye stuff with Turkey Red Oil
- Add @1 gram of Sodium Sulphate to the paste.
- Add small amount of warm water to the paste
- Make it to instructed quantity with distill water.
- If dye is not dissolved completely, heat the solution until it becomes clear.
- If there are still some turbidity in the solution then add small amount of hydro to the solution.

### Dyeing Procedure

- Take the weighted bleached cotton Hank yarn / Fabric for dyeing
- Immerse it in water bath for 10 minutes.
- Prepare dye bath with the prepared stock solution
- Add water to the bath and maintain the material to liquor ratio 1:30.
- Enter the bleached wetted hank yarn/fabric in to the dye bath for dyeing
- Raise the temperature of the bath up to 80°C .
- Add sodium chloride in the dye bath in three installments during the dyeing process
- Continue the dyeing for 60 minutes.
- Keep turning the hank yarn/fabric during the dyeing process.

## Oxidation

- Prepare an oxidation bath with 3% Potassium Dichromate and 4% Acetic Acid (33%)
- Maintain the M:L ratio 1:30
- Immerse the dyed hank yarn / fabric in to oxidation bath
- Increase the temperature of bath up to 60°C
- Continue the oxidation process for 10 minutes

## Soaping

- After oxidation take the hank yarn / fabric out.
- Prepare the soaping bath with 2gpl soda Ash & 3 gpl soap and raise the temperature of the bath to 60°C
- Impregnate the hank yarn / fabric in the soaping bath for 20 min.
- Once soaping is over take the hank yarn / fabric out and rinse them thoroughly with water
- After rinsing dry the hank yarn / fabric and store them at designated place.

## 11. Dyeing of Silk with Acid Dyes

### PREPERATORY PROCESS FOR DYEING OF SILK MATERIAL

#### DEGUMMING OF SILK:

Degumming of silk presents special features because it is usually accompanied by the removal of silk gum or sericin. The process is commonly referred to as “Boiling off”



**Degumming of Silk yarn**

## **Silk Degumming procedure**

- Take the correctly identified Silk yarn / fabric for De gumming
- Prepare a bath for degumming with Soap solution 2 gram / liter and Soda 1 gram / liter.
- Maintain Material to Liquor 1:40
- Raise temperature to Boil
- Enter the raw silk yarn / fabric for degumming.
- Soak the material into the solution and allow it to boil for two hours.
- Take the material out and wash it thoroughly in running water.
- Dry the degummed silk and store at designated place for dyeing.

## **DYEING OF SILK**

### **Material / Chemical required**

- Bleached Silk material,
- Acid Dyes,
- Formic Acid,
- Acetic Acid,
- Glauber Salt & Water.

### **Preparation of Stock Solution**

- Weight the dye stuff as instructed for the shade & colour to be dyed.
- Make a Paste of the dye stuff with the use of water.
- Add small amount of hot water to the paste and dissolve it completely.
- If dye is not dissolved completely, heat the solution until it becomes clear.
- Dilute the solution with cold water as instructed
- This is the stock solution.

## **Dyeing Procedure**

- Take the weighted Silk yarn fabric for dyeing
- Add the calculated prepared stock solution in to the water bath
- Maintain the material to liquor ratio 1:30.
- Enter the silk yarn / fabric in to the dye bath and process for 10 minutes
- Now add 5 gram of glauber salt to the solution.
- Keep turning the silk yarn / fabric for 30 min at 80°C.
- Add 2% (10 ml) Acetic Acid to the dye bath .
- Run the silk yarn or fabric for 20 min at boil.
- Now take the material out of water bath.
- Rinse it thoroughly in the running water.
- After rinsing squeeze and dry the silk yarn / fabric.



**Silk Yarn dyeing**

**Cleaning operation while dyeing:**

- ❖ Remove regularly accumulated dust and dirt on the dye bath.
- ❖ The yarn should be free from other impurities likes grease, oil stains etc.,.
- ❖ Transport the dyes and other chemicals in a proper way and ensure that spillage do not occur
- ❖ Collect all the waste and dispose them in a systematic way as instructed by supervisor.
- ❖ Maintain cleanliness in the dye bath surroundings while dyeing.

## **12. INSTRUCTIONS DURING SHIFT CHANGE OVER:**

### **Taking charge of duties while starting of shift:**

- ❖ Come at least 10 - 15 minutes earlier to the work place.
- ❖ Meet the previous shift operator and discuss regarding the issues faced by them with respect to the quality or production or safety or any other specific instruction etc.
- ❖ Understand the dyeing operation and its complete steps involved.
- ❖ Ensure the dyes and other chemicals are prepared as per requirement.
- ❖ Ensure the availability of next batch to be dyed ready near the dye bath.
- ❖ Check the cleanliness of the dye bath & other work areas.
- ❖ Question the previous shift operator for any deviation in the above and bring the same to the knowledge of the shift superior.

### **Handing over charge at the end of shift:**

- ❖ Properly hand over the shift to the incoming operator.
- ❖ Provide the details regarding fabric / yarn quality & the dyeing operation.
- ❖ Provide all relevant information regarding the problem faced in dyeing and other processes.
- ❖ Ensure to keep the next lot to be processed ready near the machine
- ❖ Get clearance from the incoming counterpart before leaving the work spot.
- ❖ Report to the shift supervisor in case the next shift operator doesn't report for the shift.
- ❖ Ensure the shift has to be properly handed over to the incoming shift operator.
- ❖ Report to the shift superior about the quality / production / safety issues/ any other issue faced in the shift and leave the department only after getting concurrence for the same from superiors.

### **13. Importance of Health and Safety:**

- ❖ Use and maintain personal protective equipment such as Hand Gloves, Gum Boots, head cap etc., as specified.
- ❖ Never handle chemicals with bare hands.
- ❖ While handling chemicals ensure that spillage do not take place.
- ❖ Store materials and equipment at their designated places.
- ❖ Minimize health and safety risks to self and others due to own actions.
- ❖ Monitor the workplace and work processes for potential risks.
- ❖ Take action based on instructions in the event of fire, emergencies or accidents, participate in mock drills/ evacuation procedures organized at the workplace as per organization procedures.