Textile Wet Processing – II

Lab Manual

Experiment no: 01

Experiment name: Study on the layout plan of wet processing-II lab.

Theory: Layout planning is deciding on the best physical arrangement of all resources that consume space within a facility. These resources might include a desk, a work center, a cabinet, a person, an entire office, or even a department, machines. Decisions about the arrangement of resources in a business are not made only when a new facility is being designed; they are made any time there is a change in the arrangement of resources, such as a machine being moved or added, or a change in procedure being implemented. Also, layout planning is performed any time there is an expansion in the facility or a space reduction.

Objective:

- To know the location of wet process-II lab.
- To know the space utilization of the lab.
- To know which machine is located in which place in the lab.

Apparatus:

- Measuring tape
- Scale
- Pencil
- Eraser

Layout of the lab:

Conclusion: We see that the space of our lab is properly utilized.

Experiment no: 02

Experiment name: Study on the laboratory dyeing machine.

Theory: Laboratory dyeing machine is very important for new shade development and fulfilling customer's requirement.

Objectives:

- To learn about the machine.
- To know the working principle of the machine.
- To know maintenance of the machine.

Specification:

Brand:

Origin:

Dimension:

Number of dye pots:

Heating system:

RPM:

Maximum temperature:

Functions:

- It can be used for pretreatment of textile materials.
- It can be used for cotton, viscose fiber dyeing.
- It can be used for high temperature high pressure polyester dyeing.
- It can be used for any type batch process of textile wet process.

Conclusion: A laboratory dyeing machine is very important for any type of textile wet process.

Experiment no: 03

Experiment name: Dyeing of 100% cotton fabric with reactive dye (Isothermal process).

Theory: Nowadays reactive dyes are very popular for textile coloration because of its some specific properties like color fastness, wide range of shade, brilliance of shade and simple application procedure. It reacts with fiber in presence of alkali and adheres as a part of fiber. In isothermal process both dye migration and fixation occur in 60°C.

Objectives:

- To learn about the dyeing process of cotton fabric by reactive dye in isothermal process.
- To dye cotton fabric by reactive dye.

Apparatus:

- Beaker.
- Measuring Cylinder.
- Pipette.
- Pot.
- Tri-pod stand.
- Gas Burner.
- Pot.
- Digital Balance.
- Scissor.

Typical Recipe:

SL	Process Parameter	Unit	Dossing	Stock solution %
01	Levelling Agent	g/L	1	1%
02	Dyes	%	2	1%
03	Glauber Salt	g/L	40	15%
04	Soda Ash	g/L	10	10%
05	Sample Weight	gm	5	---
06	M: L	-----	1:30	---
07	Temperature	°C	60	---
08	Time	min	20	----

Recipe calculation:

Total Liquor = Material Weight X L {M: L}
= 5gm X 30
= 150 mL

Reactive Dye $= \frac{5\ X\ 2\%}{1\%}$ mL ($\frac{Material\ weight\ X\ chemical\ amount\ (\%)}{stock\ solution\ (\%)}$)
= 10 mL

Soda Ash $= \frac{150\ X\ 10}{10\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%) X\ 1000}$)
= 15mL

Levelling Agent $= \frac{150\ X\ 1}{1\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%) X\ 1000}$)
= 15mL

Glauber Salt $= \frac{150\ X\ 40}{15\%\ X\ 1000}$ ml ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%) X\ 1000}$)
= 15mL

Initial Water = Total Liquor - (chemicals)
= 150- (15+40+15+10) mL
= 150 -80 ml
= 70ml

Function of chemicals:

Name of chemicals	Function
Reactive Dye	Coloring Substances to dye the fabric.
Soda Ash	To maintain pH of the dye bath.
Levelling Agent	Reduce surface tension for easy penetration of dyes into fabric.
Glauber Salt	Used as electrolyte.

Process flow:

Collection of pre-treated sample
↓
Set water level
↓
Add leveling agent
↓
Add dye solution
↓

Add salt solution
↓
Add soda ash solution
↓
Add fabric sample
↓
Raise the temperature to 60°c
↓
Run time for 30 minutes
↓
Bath drop
↓
Rinsing
↓
Hot wash at 90°c for 10minute
↓
Drying

Figure 2.3.1: process flow chart

Process curve:

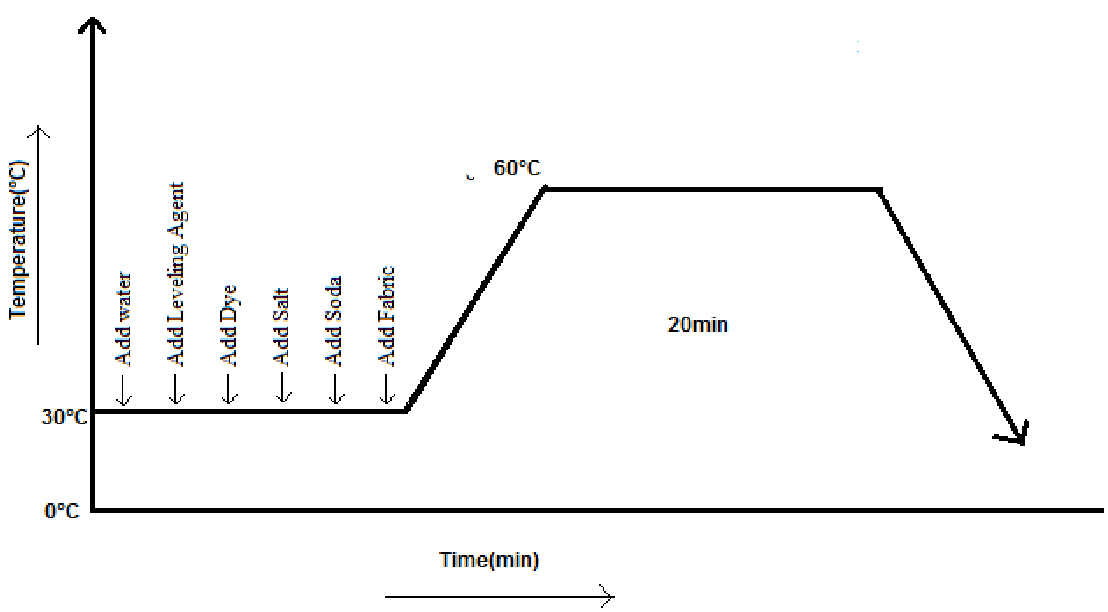


Figure 2.3.2: dyeing curve

Sample attachment:

Conclusion & Comments: We can say this experiment is successful because our treated fabric absorbed the dye solution & we also observed it bleed very low amount of dyes during hot & cold wash its due to optimum temperature and good quality of dyes and chemicals.

Experiment no: 04

Experiment name: Dyeing of 100% cotton fabric with reactive turquoise dye (Migration process).

Theory: Nowadays reactive dyes are very popular for textile coloration because of its some specific properties like color fastness, wide range of shade, brilliance of shade and simple application procedure. Turquoise color is very popular and it is a phthalocyanine dye which molecular size is large and for which it is dyed in high temperature. This is called migration process dyeing. In migration process dye migration occurs at 80°C and fixation occurs at 60°C.

Objectives:

- To learn about the dyeing process of cotton fabric by reactive dye in migration process.
- To dye cotton fabric by reactive dye.

Apparatus:

- Beaker.
- Measuring Cylinder.
- Pipette.
- Lab dyeing machine
- Digital Balance.
- Scissor.

Typical recipe:

SL	Process Parameter	Unit	Dossing	Stock solution %
01	Levelling Agent	g/L	1	1%
02	Dyes (Turquoise dye)	%	2.5	1%
03	Glauber Salt	g/L	60	15%

04	Soda Ash	g/L	10	10%
05	Sample Weight	gm	5	---
06	M: L	-----	1:30	---
07	Temperature	°C	60	---
08	Time	min	20	----

Recipe calculation:

Total Liquor = Material Weight X L {M: L}
= 5gm X 30
= 150 mL

Reactive Dye $= \frac{5\ X\ 2.5\%}{1\%}$ mL ($\frac{Material\ weight\ X\ chemical\ amount\ (\%)}{stock\ solution\ (\%)}$)
= 12.5 mL

Soda Ash $= \frac{150\ X\ 10}{10\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%) X\ 1000}$)
= 15mL

Levelling Agent $= \frac{150\ X\ 1}{1\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%) X\ 1000}$)
= 15mL

Glauber Salt $= \frac{150\ X\ 60}{15\%\ X\ 1000}$ ml ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%) X\ 1000}$)
= 60 mL

Initial Water = Total Liquor - (chemicals)
= 150- (12.5+15+15+60) mL
= 150 -80 ml
= 47.5 ml

Function of chemicals:

Name of chemicals	Function
Reactive Dye	Coloring Substances to dye the fabric.
Soda Ash	To maintain pH of the dye bath.
Levelling Agent	Reduce surface tension for easy penetration of dyes into fabric.
Glauber Salt	Used as electrolyte.

Process flow:

Collection of pre-treated samples
↓
Set water level
↓

Add leveling agent

↓

Add dye solution

↓

Add salt solution

↓

Add soda ash solution

↓

Add fabric sample

↓

Raise the temperature to 80°c

↓

Run time for 30 minutes

↓

Bath drop

↓

Rinsing

↓

Hot wash at 90°c for 10minute

↓

Drying

Figure 2.4.1: process flow chart

Process curve:

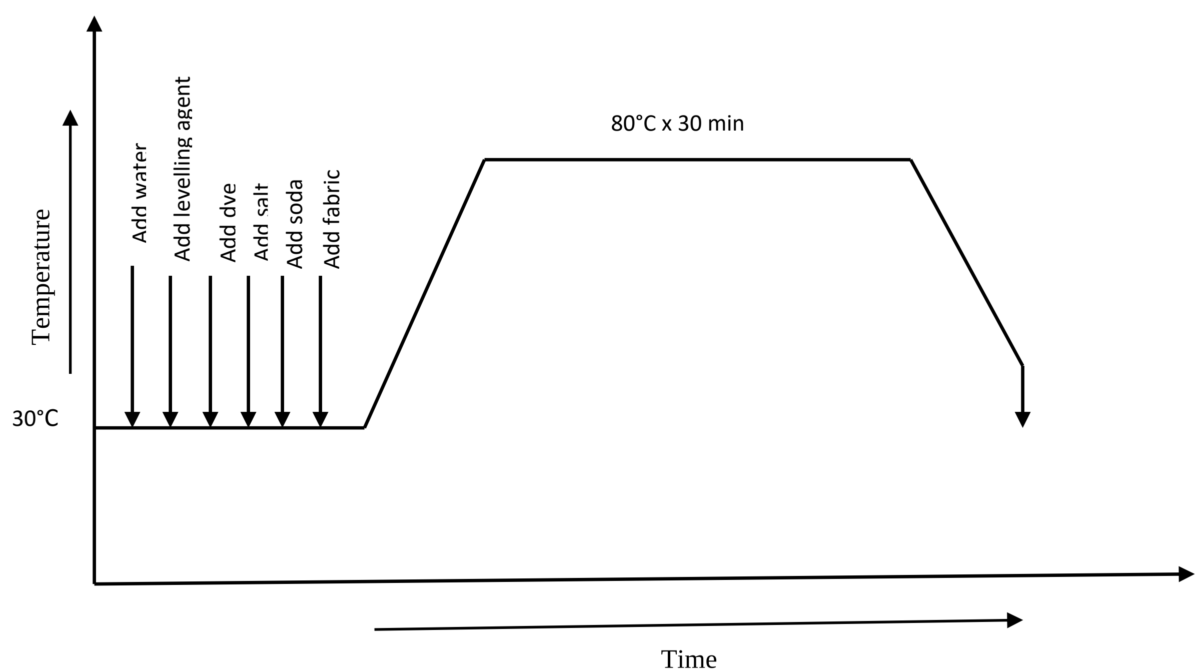


Figure 2.4.2: dyeing curve

Sample attachment:

Conclusion & Comments: We can say this experiment is successful because our treated fabric absorbed the dye solution & we also observed it bleed very low amount of dyes during hot & cold wash its due to optimum temperature and good quality of dyes and chemicals.

Experiment no: 05

Experiment name: Dyeing of 100% polyester fabric with disperse dye (Carrier method).

Theory: The term "disperse dye" have been applied to the organic coloring substances which are free from ionizing groups, are of low water solubility and are suitable for dyeing hydrophobic fibres. Disperse dyes have substantivity for one or more hydrophobic fibres e.g., cellulose acetate, nylon, polyester, acrylic and other synthetic fibres. The negative charge on the surface of hydrophobic fibres like polyester cannot be reduced by any means, so non-ionic dyes like disperse dyes are used which are not influenced by that surface charge. Carrier used in disperse dyes to reduce the temperature compare to conventional high temperature method.

Objectives:

- To learn about dyeing process of polyester fabric by disperse dye.
- To dye polyester fabric by disperse dye.

Apparatus:

- Beaker.
- Measuring Cylinder.
- Pipette.

- Lab dyeing machine
- Digital Balance.
- Scissor.

Typical recipe:

SL	Process Parameter	Unit	Dossing	Stock soln:
01	Disperse Dye	%	1	1%
02	Carrier	g/L	2	1%
03	Dispersing Agent	g/L	1	1%
04	Acetic Acid	ml	0.5	-
05	M: L	---	1:30	-
06	Fabric Weight	gm	5	-
07	Temperature	°C	100	-
08	Time	min	20	-

Recipe calculation:

Total Liquor = Material Weight X L {M: L}

= 5gm X 30

= 150 mL

Disperse Dye $= \frac{5\ X\ 1\%}{1\%}$ mL ($\frac{Material\ weight\ X\ chemical\ amount\ (\%)}{stock\ solution\ (\%)}$)

= 5 mL

Carrier $= \frac{150\ X\ 2}{1\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%)X\ 1000}$)

= 30mL

Dispersing Agent $= \frac{150\ X\ 1}{1\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%)X\ 1000}$)

= 15mL

Acetic Acid $= \frac{150\ X\ 0.5}{1\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%)X\ 1000}$)

= 7.5mL

Initial Water = Total Liquor - (chemicals)
= 150- (5+30+15+7.5) mL
= 150 -57.5 mL
= 92.5mL

Function of chemicals:

Name of chemicals	Function
Disperse Dye	Coloring Substances to dye the fabric.
Acetic Acid	To maintain pH of the dye bath.
Dispersing Agent	To reduce molecular size of disperse dye.
Carrier	It helps to increase affinity between dyes and fabric surface.

Process flow:

Collection of samples
↓
Set water level
↓
Add Acetic acid solution
↓
check pH
↓
Add carrier solution
↓
Add dispersing agent solution
↓
Add disperse dye solution
↓
Add fabric sample
↓
Raise temperature to 90°C
↓
Run time for 20 minutes
↓
Bath Drop
↓
Rinsing
↓
Drying

Figure 2.5.1: process flow chart

Process curve:

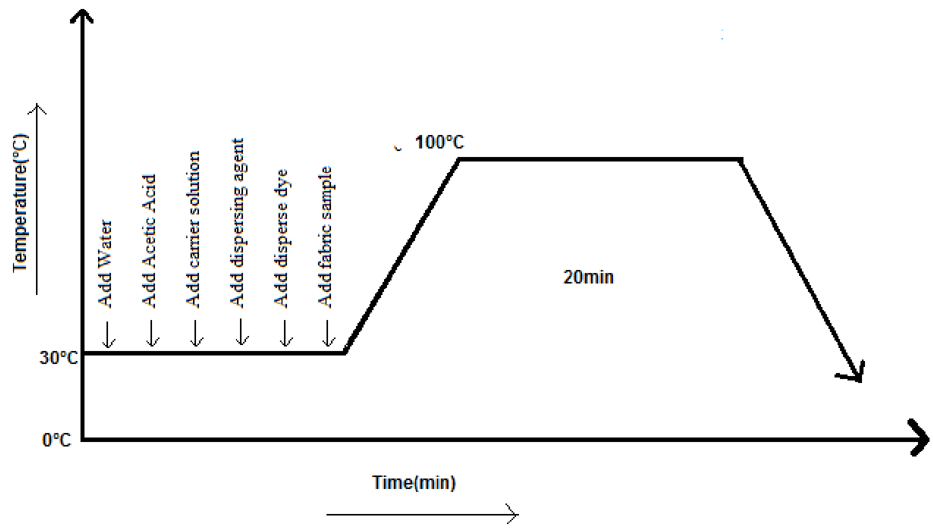


Figure 2.5.2: dyeing curve

Sample attachment:

Conclusion & Comments: We can say this experiment is successful cause our treated fabric absorbed the dye solution & we also observed it bleed very low amount of dyes during hot & cold wash its due to optimum temperature and good quality of dyes and chemicals.

Experiment no: 06

Experiment name: Dyeing of 100% polyester fabric with disperse dye (HTHP method).

Theory: The term "disperse dye" have been applied to the organic coloring substances which are free from ionizing groups, are of low water solubility and are suitable for dyeing hydrophobic fibres. Disperse dyes have substantivity for one or more hydrophobic fibres e.g., cellulose acetate, nylon, polyester, acrylic and other synthetic fibres. The negative charge on the surface of hydrophobic fibres like polyester cannot be reduced by any means, so non-ionic dyes like disperse dyes are used which are not influenced by that surface charge.

Objective:

- To learn about dyeing process of polyester fabric by disperse dye.
- To dye polyester fabric by disperse dye.

Apparatus:

- Beaker.
- Measuring Cylinder.
- Pipette.
- Lab dyeing machine.
- Digital Balance.
- Scissor.

Typical recipe:

SL	Process Parameter	Unit	Dossing	Stock soln:
01	Disperse Dye	%	1	1%
02	Carrier	g/L	2	1%
03	Dispersing Agent	g/L	1	1%
04	Acetic Acid	ml	0.5	-
05	M: L	---	1:30	-
06	Fabric Weight	gm	5	-
07	Temperature	°C	130	-
08	Time	min	20	-

Recipe calculation:

Total Liquor = Material Weight X L {M: L}
= 5gm X 30
= 150 mL

Disperse Dye = $\frac{5 \ X \ 1\%}{1\%}$ mL ($\frac{Material \ weight \ X \ chemical \ amount \ (\%)}{stock \ solution \ (\%)}$)
= 5 mL

Dispersing Agent = $\frac{150 \ X \ 1}{1\% \ X \ 1000}$ mL ($\frac{Total \ Liquor \ X \ chemical \ amount \ in \ gm/L}{Stock \ solution(\%) X \ 1000}$)
= 15mL

Acetic Acid = $\frac{150 \ X \ 0.5}{1\% \ X \ 1000}$ mL ($\frac{Total \ Liquor \ X \ chemical \ amount \ in \ gm/L}{Stock \ solution(\%) X \ 1000}$)
= 7.5mL

Initial Water = Total Liquor - (chemicals)
= 150- (5+15+7.5) mL
= 150 -27.5 mL
= 122.5mL

Function of chemicals:

Name of chemicals	Function
Disperse Dye	Coloring Substances to dye the fabric.
Acetic Acid	To maintain pH of the dye bath.
Dispersing Agent	To reduce molecular size of disperse dye.

Process flow:

Collection of samples
↓
Set water level
↓
Add Acetic acid solution
↓
check pH
↓
Add dispersing agent solution
↓
Add disperse dye solution
↓
Add fabric sample
↓
Raise temperature to 90°C
↓
Run time for 20 minutes
↓

Bath Drop
↓
Rinsing
↓
Drying

Figure 2.6.1: process flow chart

Process curve:

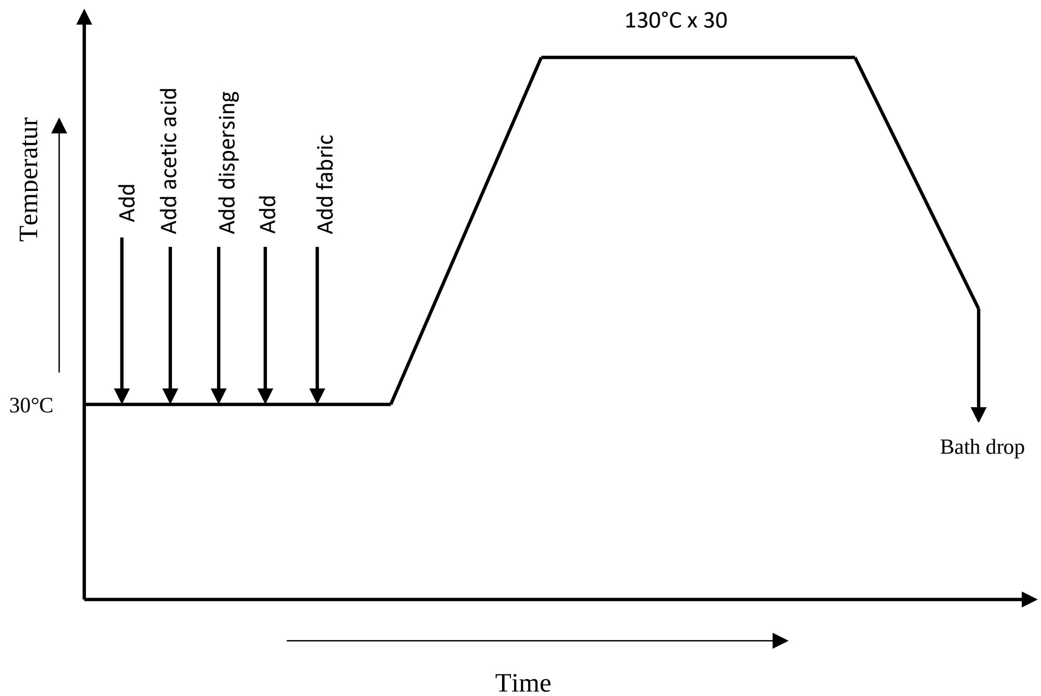


Figure 2.6.2: dyeing curve

Sample attachment:

Conclusion & Comments: We can say this experiment is successful cause our treated fabric absorbed the dye solution & we also observed it bleed very low amount of dyes during hot & cold wash its due to optimum temperature and good quality of dyes and chemicals.

Experiment no: 07

Experiment name: Dyeing of 100% cotton fabric with Sulphur dye.

Theory: Sulphur dye is water insoluble dye. We know that during dyeing the dye must be solubilized form. To make the Sulphur dye soluble it is needed to reduce the dye with the help of sodium sulfide (Na_2S) and soda ash (Na_2CO_3). Then dyeing is done. To insoluble the dye after dyeing to improve the color fastness to wash the oxidation is done. The process is as below-

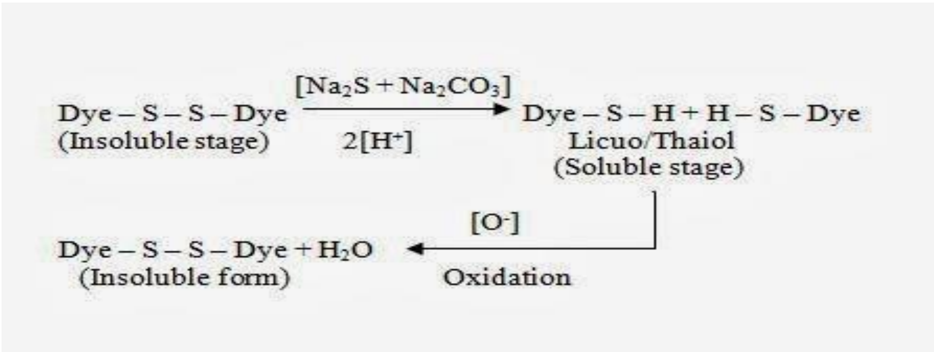


Figure 2.7.1: Sulphur dye mechanism

Objective:

- To learn about Sulphur dye.
- To dye cotton fabric with Sulphur dye.

Apparatus:

- Beaker.
- Measuring Cylinder.
- Pipette.
- Pot.
- Tri-pod stand.
- Gas Burner.
- Sample dyeing machine
- Digital Balance.
- Scissor.

Typical recipe:

SL	Process Parameter	Unit	Dossing	Stock soln:

01	Dyes	%	4	1%
02	Na_2S	g/L	10	10%
03	Wetting Agent	g/L	1	1%
04	Glauber Salt	g/L	10	10%
05	Levelling Agent	g/L	1	1%
06	Soda Ash	g/L	5	3%
07	Sample Weight	gm	5	---
08	M: L	-----	1:30	---
09	Temperature	°C	95	----
10	Time	min	30	----

Recipe calculation:

Total Liquor = Material Weight {M: L}
= 5gm X 30
= 150 mL

Disperse Dye = $\frac{5\ X\ 4\%}{1\%}$ mL ($\frac{Material\ weight\ X\ chemical\ amount\ (\%)}{stock\ solution\ (\%)}$)
= 20 mL

Na_2S = $\frac{150\ X\ 10}{10\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%) X\ 1000}$)
= 15mL

Glauber Salt = $\frac{150\ X\ 10}{10\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%) X\ 1000}$)
= 15mL

Wetting Agent = $\frac{150\ X\ 1}{1\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%) X\ 1000}$)
= 15mL

Levelling Agent = $\frac{150\ X\ 1}{1\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%) X\ 1000}$)
= 15mL

Initial Water = Total Liquor - (chemicals)
= 150 - (15+15+15+15+20) mL
= 150 - 80 mL
= 70 mL

Function of chemicals:

Name of chemicals	Function

Sulphur Dye	Coloring Substances to dye the fabric.
Na_2S	It is a reducing agent.
Wetting Agent	It reduces surface tension of water.
Glauber Salt	Its work as electrolyte.

Process flow:

Collection of pre-treated samples
↓
Set water level
↓
Add dye solution
↓
Add Na_2S solution
↓
Add wetting agent solution
↓
Add levelling agent solution
↓
Add Glauber salt solution
↓
Add soda ash
↓
Add fabric sample
↓
Raise the temperature to 55°C
↓
Run time for 30 minutes
↓
Bath drops at 70°C
↓
Rinsing
↓
Drying

Figure 2.7.2: process flow chart

Process curve:

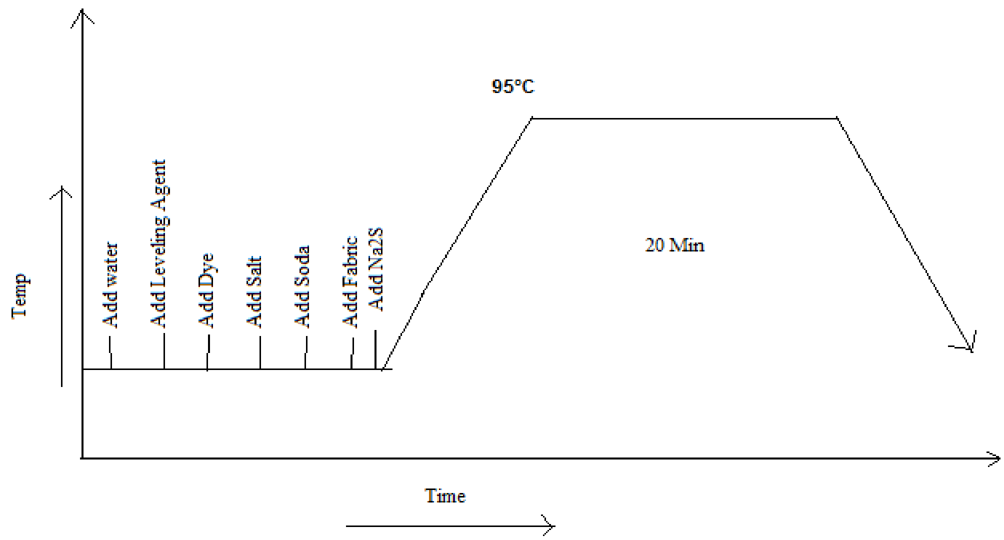


Figure 2.7.3: dyeing curve

Sample attachment:

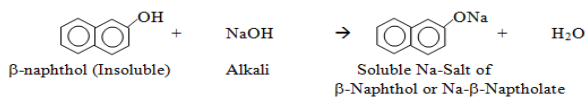
Conclusion & Comments: We can say this experiment is successful cause our treated fabric absorbed the dye solution & we also observed it bleed very low amount of dyes during hot & cold wash its due to optimum temperature and good quality of dyes and chemicals.

Experiment no: 08

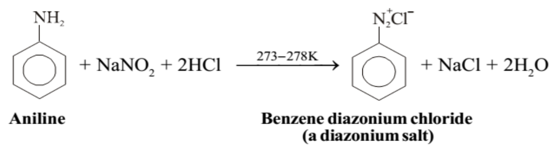
Experiment name: Dyeing of cotton fabric with azoic dye.

Theory: Dyeing of cotton fabric with azo dye is occurred in 3 steps as below-

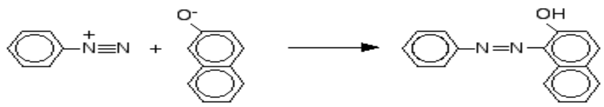
1. Naphtholation: Naphthol are insoluble in water and they are converted into water soluble form by treating with alkali.



2. Diazotization: A base containing amino (-NH_2) group reacts with the sodium nitrite ($NaNO_2$) to form a solution of diazonium chloride of that base in the presence of excess hydrochloric acid (HCl).



3. Coupling: The impregnated material is treated in a bath containing diazonium solution to carry out to coupling and thus color is produced inside the fabric.



Objective:

- To learn about azo dye.
- To dye cotton fabric with azoic dye.

Apparatus:

- Beaker.
- Measuring Cylinder.
- Pipette.
- Pot.
- ice
- Digital Balance.

- Scissor.

Typical recipe: Naphtholation

SL	Process Parameter	Unit	Dossing	Stock soln:
01	Naphthol AS	g/L	14	------------
02	Caustic soda	g/L	22.5	------------
03	Wetting Agent	g/L	1	1%
04	Common salt	g/L	30	--------
05	M: L	-----	1:50	---
06	Temperature	°C	Room temperature	----
07	Time	min	15	----

Diazotization:

SL	Process Parameter	Unit	Dossing	Stock soln:
01	Base	g/L	15	------------
02	HCl	ml/L	14	------------
03	Sodium nitrite	g/L	15	------------
04	Sodium acetate	g/L	12	------------
05	Acetic acid	ml/L	8	------------
06	M: L	-----	1:50	---
07	Temperature	°C	0-5	----
08	Time	min	20 min	----

Recipe calculation: (Naphtholation)

Total Liquor = Material Weight X L {M: L}
= 5gm X 50
= 250 mL

Naphthol AS = $\frac{250\ X\ 14}{1000}$ = 3.5 gm

Wetting Agent = $\frac{250\ X\ 1}{1\%\ X\ 1000}$ mL ($\frac{Total\ Liquor\ X\ chemical\ amount\ in\ gm/L}{Stock\ solution(\%) X\ 1000}$)
= 25mL

Caustic soda = $\frac{250\ X\ 22.5}{1000}$ = 5.625 gm

Initial water = (250 – 25) ml = 225 ml

Recipe calculation: (Diazotization)

Total Liquor = Material Weight X L {M: L}
= 5gm X 50
= 250 mL

Base = $\frac{250\ X\ 15}{1000}$ = 3.75 gm

Hydrochloric acid = $\frac{250\ X\ 14}{1000}$ = 3.5 ml

Sodium nitrite = $\frac{250\ X\ 15}{1000}$ = 3.75 gm

Sodium acetate = $\frac{250\ X\ 12}{1000}$ = 3 g

Acetic acid = $\frac{250\ X\ 8}{1000}$ = 2 ml

Function of chemicals:

Name of chemicals	**Function**
Naphthol AS	Coupling component to dye the fabric.
Caustic soda	It is used to solubilize the naphthol
Wetting Agent	It reduces surface tension of water.
Base	It is main compound for diazotization reaction (mainly color producing substance)
Common salt	Increase affinity of naphthol to cotton fiber
Hydrochloric acid and sodium nitrite	They are used for diazotization reaction to produce nitric acid

Process flow for Naphtholation:

Taking required amount of Naphthol

↓

↓

Prepare a paste by mixing wetting agent with Naphthol

Pour required amount of water in the paste

↓

Add required amount of NaOH in it

↓

Dip the sample in this solution and kept for 15 min

↓

Dry

Figure 2.8.1: Naphtholation process flow

Process flow for diazotization:

Prepare paste by mixing required amount of Base with required amount of acetic acid

↓

Pour required amount of water in it

↓

Add sodium acetate in it

↓

Add sodium nitrite

↓

Add required amount of hydrochloric acid in it and maintain 0-5°C temperature

↓

Dip the naphtholated sample fabric in this solution

↓

Wash

↓

Dry

Figure 2.8.1: Diazotization process flow

Sample Attachment:

Conclusion & Comments: We can say this experiment is successful cause our treated fabric absorbed the dye solution & we also observed that this dyeing process is completed in 3 stages.

Experiment no: 09

Experiment name: Printing on 100% cotton fabric with reactive dye by screen printing method.

Theory: The printing of textile material is the application of color according to predetermined design. In direct style the dyes are directly printed at the required places of the fabric. Nowadays screen printing is by far the most common technology today. There are two types of screen-printing system.

Objective:

- To learn about printing process of cotton fabric by reactive dye.
- To learn about screen printing method.

Method Of Printing: We used here screen-printing method.

Style of Printing: We used here direct style for printing which means the dyes are printed directly at the required places of fabric and leaving the other portion unprinted or white.

Equipment List:

- Beaker.
- Measuring Cylinder.
- Glass rod
- Pot
- Burner
- Pipette.

- Steamer
- Digital Balance.
- Scissor.
- Printing Screen Board

Typical recipe:

SL	Process Parameter	Unit	Dossing
01	Reactive Dye	Parts	2
02	Urea	Parts	5
03	Resist salt	Parts	2
04	Soda ash	Parts	1
05	Sodium alginate	Parts	65
05	Water	Parts	25
06	Total	Parts	100

Function of chemicals:

Name of chemicals	Function
Reactive Dye	Coloring Substances to dye the fabric.
Resist salt	Mild oxidizing agent and prevent reduction of dyes in alkaline print paste and in closed dyeing system.
Soda Ash	To maintain pH of the print paste.
Urea	Hygroscopic agent which retains moisture which helps dye diffusion.
Thickener	To maintain viscosity of print paste.

Process flow:

Taking pre-treated 100% cotton fabric sample

↓

Urea + dye + boiled water = paste – 1

↓

Paste – 1 + thickener = paste – 2

↓

Paste – 2 + soda ash = print paste

↓

Application of this print paste on fabric by screen and squeezer

↓

Dry at room temperature

↓

Steam at 100°C

↓

Soap wash

Figure 2.9.1: Reactive dye print process flow

Sample attachment:

Conclusion and comments: We can say this experiment is as successful desired cause it seems some uneven printing done due to faulty screen and high viscosity of print paste.

Experiment no: 10

Experiment name: Printing of 100% cotton fabric with Sulphur dye by screen printing method.

Theory: The Printing of textile materials is the application of color according to a predetermined design. The printing paste which applied to textile material consists of dye, water, thickener and hydrocarbon solvent or oil. After the printing paste is applied, the textile material is usually steamed. Once the acid dye printing paste has been applied to the textile material, steaming of printed pattern is necessary. The steam provides the water molecules and heat energy to enable the dye molecules of the printing paste to transfer from the fiber surface into the polymer system.

Objective:

- To learn about printing process of cotton fabric by Sulphur dye.

- To learn about screen printing method.

Method Of Printing: We used here screen-printing method.

Style of Printing: We used here direct style for printing which means the dyes are printed directly at the required places of fabric and leaving the other portion unprinted or white.

Equipment List:

- Beaker.
- Measuring Cylinder.
- Pipette.
- Pot
- Burner
- Steamer
- Digital Balance.
- Scissor.
- Printing Screen Board.

Typical printing recipe:

❖ SL	Process Parameter	Unit	Dossing
01	Sulphur Dye	Parts	3
02	Na_2S	Parts	3
03	Soda Ash	Parts	2
04	Glauber Salt	Parts	4
05	Thickener	Parts	70
06	Water	Parts	18
07	Total	Parts	100

Function of chemicals:

Name of chemicals	Function
Sulphur Dye	Coloring Substances to dye the fabric.
Na_2S	It's a reducing agent.
Soda Ash	To maintain pH of the print paste.
Thickener	To maintain viscosity of print paste.

Process flow:

Collection of pre-treated 100% silk fabric.

↓
Preparation of print paste with thickener.
↓
Application of print paste on pre-treated sample according to printing method
↓
Drying at Room temperature
↓
Steaming at 90°C for 5 minutes
↓
After Treatment
↓
Drying

Figure 2.10.1: Process flow chart

Sample attachment:

Conclusion and comments: We can say this experiment is as successful desired cause it seems some uneven printing done due to faulty screen and high viscosity of print paste.

Experiment no: 11

Experiment name: Printing on 100% polyester fabric with disperse dye by screen printing method.

Theory: The Printing of textile materials is the application of color according to a predetermined design. The printing paste which applied to textile material consists of dye, water, thickener and hydrocarbon solvent or oil. After the printing paste is applied, the textile material is usually steamed. Once the acid dye printing paste has been applied to the textile material, steaming of printed pattern is necessary. The steam provides the water molecules and heat energy to enable the dye molecules of the printing paste to transfer from the fiber surface into the polymer system.

Objective:

- To learn about printing process of polyester fabric by disperse dye.
- To learn about screen printing method.

Printing method: We use screen printing method.

Printing style: Direct printing style.

Equipment List:

- Beaker.
- Measuring Cylinder.
- Pipette.
- Pot
- Glass rod
- Burner
- Digital Balance.
- Scissor.
- Printing Screen Board.

Typical recipe:

SL	Process Parameter	Unit	Dossing
01	Disperse Dye	Parts	3
02	Acetic Acid	Parts	2
03	Dispersing Agent	Parts	1
04	Thickener	Parts	75
05	Water	Parts	19
06	Total	Parts	100

Function of chemicals:

Name of chemicals	Function
Disperse Dye	Coloring Substances to dye the fabric.
Acetic Acid	To maintain pH of the dye bath.
Dispersing Agent	To reduce molecular size of disperse dye.
Thickener	To maintain viscosity of print paste.

Process flow:

Collection of pre-treated 100% polyester fabric.

↓

Preparation of print paste with thickener.

↓

Application of print paste on pre-treated sample according to printing method

↓

Drying at Room temperature

↓

Steaming at 110°C for 5 minutes

↓
After Treatment
↓
Drying

Figure 2.11.1: Process flow chart

Sample attachment:

Conclusion & Comments: We can say this experiment is not successful as desired cause it seems some uneven printing done due to faulty screen.

Experiment no: 12

Experiment name: Printing on 100% cotton fabric with azoic dye by screen printing method.

Theory: The Printing of textile materials is the application of color according to a predetermined design. The printing paste which applied to textile material consists of dye, water, thickener and hydrocarbon solvent or oil. After the printing paste is applied, the textile material is usually steamed. Once the acid dye printing paste has been applied to the textile material, steaming of printed pattern is necessary. The steam provides the water molecules and heat energy to enable the dye molecules of the printing paste to transfer from the fiber surface into the polymer system.

Objective:

- To learn about printing process of cotton fabric by azoic dye.
- To learn about screen printing method.

Printing method: We use screen printing method.

Printing style: Direct printing style.

Equipment List:

- Beaker.
- Measuring Cylinder.

- Pipette.
- Digital Balance.
- Pot
- Burner
- Glass rod
- Scissor.
- Printing Screen Board.

Typical recipe for naphtholation:

SL	Process Parameter	Unit	Dossing
01	Naphthol	Parts	2
02	Wetting agent	Parts	1
03	Alkali (NaOH)	Parts	5-6
04	Common Salt	Parts	5-10

Typical recipe for base printing:

SL	Process Parameter	Unit	Dossing
01	Fast base	Parts	20
02	HCl	Parts	30
03	Sodium Nitrite	Parts	20
04	Thickener (8% starch)	Parts	700
05	Acetic acid	Parts	10
06	Sodium acetate	Parts	15
07	Water	Parts	As required to fill up 1000 parts

Function of chemicals:

Name of chemicals	Function
Naphthol AS	Coupling component to dye the fabric.
Caustic soda	It is used to solubilize the naphthol
Wetting Agent	It reduces surface tension of water.
Base	It is main compound for diazotization reaction (mainly color producing substance)
Hydrochloric acid and sodium nitrite	They are used for diazotization reaction to produce nitric acid
Common salt	Increase affinity of sodium naphtholate to cotton fiber
Thickener	Used to maintain print paste viscosity and to hold the print paste in place on fabric

Acetic acid and sodium acetate	Acts as buffering agent

Process flow:

Collection of pre-treated 100% cotton fabric.
↓
Preparation of print paste with thickener.
↓
Application of print paste on pre-treated sample according to printing method
↓
Drying at (90°C x 10”)
↓
Steaming at 105°C for 15 minutes
↓
After Treatment (Soaping with 1 g/L detergent following by washing)
↓
Drying

Figure 2.12.1: Process flow chart

Sample attachment:

Conclusion & Comments: We can say this experiment is successful cause there was even, sharp printing outline.

Experiment No: 13

Experiment name: Mercerization of 100% cotton woven fabric by padding method.

Theory: Mercerization is a physio-chemical process where cotton goods are treated with 21-22% caustic soda at room temperature. At this stage swelling of fiber occurs and breaks the weak van-dar-walls force between cellulose chain molecules and it allows re-arrangement, expansion and re-orientation.

$$\text{Cell-OH} + NaOH = \text{Cell-ONa} + H_2O$$

Cotton fiber's cross section become round shape from kidney shape by mercerization.

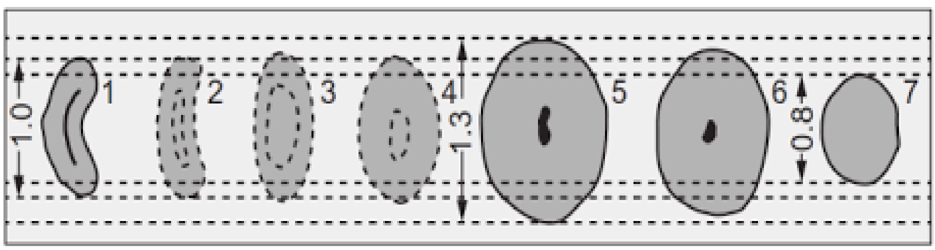


Figure 2.13.1: Process flow chart

Objectives:

- To increase the strength of cotton fiber.
- To increase dyeability of cotton.
- To increase luster.
- To increase reactivity.
- To enhanced color fastness.

Apparatus:

- Beaker.
- Measuring Cylinder.
- Pipette.
- Glass rod.
- Digital Balance.

- Scissor
- Padding mangle
- Dryer

Typical recipe:

Serial No	Chemical Name	Amount	Unit	Stock solution%	Function of Chemicals
1	Caustic soda	21	%	------------	Swells cotton fiber.
2	Wetting agent	1	g/L	-----------	Reduce surface tension.
3	Temperature	Room temperature			
4	Time	30-60	Seconds		To maintain P^H.

Recipe Calculation:

Water = 500 ml = 0.5 L

Caustic soda = (21/100) X 500 = 105 g

Wetting agent = 1 X 0.5 = 0.5 g

Process flow chart:

Chemical solution preparation

↓

Padding in the chemical solution

↓

Washing

↓

Neutralization with acidic solution

↓

Washing

↓

Drying

Figure 2.13.2: Process flow chart

Sample attachment:

Conclusion and Comments: We can say this experiment is successful cause our treated fabric has increased luster and for being sure we measure BAN.

Experiment no: 14

Experiment Name: Crease recovery or resin finish on 100% cotton fabric.

Theory: Crease means bending, twisting or deformation of a material. Crease recovery means that the fabric can bend and twist and then recover from this deformation. Free -OH groups in the amorphous region of cotton are mainly responsible for crease formation. If these free -OH groups can be blocked, the crease recovery ability of the material will be improved. In resin finishing the material is treated with resin and the free -OH groups of amorphous regions are crosslinked with resin and thus block free -OH groups. This prevents hydrogen bond formation among adjacent cellulose macromolecules while folding or pressing and thus improving crease recovery ability of the treated material.

Objectives:

- To learn reasons of crease formation in cotton fabric.
- To know how resin finish prevents crease formation.
- To apply resin finish on 100% cotton fabric.
- To evaluate the test result with Shirley crease recovery tester.

Apparatus:

- Beaker.
- Measuring Cylinder.
- Pipette.
- Glass rod.

- Digital Balance.
- Scissor
- Padding mangle
- Dryer.

Typical recipe:

Serial No	**Chemical Name**	**Amount**	**Unit**	**Stock solution%**	**Function of Chemicals**
1	Cross linking agent	65	g/L	------------------	Blocks free -OH groups of amorphous regions of cotton.
2	Catalyst	15	g/L	-------------------	Accelerates the cross-linking reaction.
3	Wetting agent	1	g/L	------------------	Reduce surface tension.
4	Acetic acid	As required to maintain P^H 4.5-5	ml/L	-----------------	To maintain P^H.
5	P^H	4.5-5	------	-----------------------	---
6	Temperature	150	°C		Curing temperature
7	Time	4-5	min		
8	Pick Up	60-65	%		

Recipe Calculation:

The chemical will be applied in padding process. We have prepared 500ml solution.

Water = 500ml = 500/1000 L = 0.5 L

Cross linking agent = 0.5X65 g = 32.5 g

Catalyst = 0.5X15 g = 7.5 g

Wetting agent = 0.5X 1 g= 0.5 g

Process Flow:

Chemical solution preparation

↓

Impregnate

↓

Drying at high temperature

↓

Wash

Sample attachment:

Conclusion and Comments: We can say this experiment is successful cause our treated fabric has increased crease recovery angle and for being sure we have done Shirley crease recovery test.

Experiment no: 15

Experiment name: Water repellent finish on 100% cotton woven fabric by padding method.

Theory: Water repellent finishes achieve their properties by reducing the free energy at fiber surfaces. If the adhesive interaction between a fiber and a drop of liquid placed on the fiber are greater than the internal cohesive interactions within the liquid, the drop will spread. If the adhesive interactions between the fiber and the liquid are less than the internal cohesive interactions within the liquid, the drop will not spread. Surfaces that exhibit low interactions with liquids are referred as low energy surface. Their critical surface energy or surface tension must be lower than the surface tension of the liquid that is repelled.

Objective:

- To know about water repellent finish.
- To know the mechanism of water repellent finish.

Apparatus:

- Beaker.
- Measuring Cylinder.
- Pipette.
- Glass rod.

- Digital Balance.
- Scissor
- Padding mangle
- Dryer.

Typical recipe:

Serial No	Chemical Name	Amount	Unit	Stock solution %	Function of Chemicals
1	Water repellent agent	50	g/L	------------	Imparts water repellency by reducing surface energy of cotton.
2	Wetting agent	1	g/L	-----------	Reduce surface tension.
3	Acetic acid	As required to maintain P^H 4.5-5			
4	Pick up	70-80	%		

Recipe calculation:

Water = 500 ml = 0.5L

Water repellent agent = 50 X 0.5 = 25 g

Wetting agent = 1 X 0.5 = 0.5 g

Process flow chart:

Chemical solution preparation

↓

Padding

↓

Drying (90-100 °C x 3 min)

↓

Curing (150-160°C x 2 min)

Figure 2.15.1: Process flow chart

Sample attachment:

Conclusion and Comments: We can say this experiment is successful cause our treated fabric is water repellent.