Unit - II

Main parts of a Reactive dye:

* Solubilising group (SO_3Na, $COONa$)
* Chromogenic group ($-N=N-$; NO_2)
* Reactive group (Cl, Br, F)
* Bridging group ($-NH-$ [imino])

Properties of reactive dye:

* Soluble in water
* Has a low substantivity to cotton so require large quantities of salt for exhaustion.
* Dyes react with cotton and forms covalent bond
* Covalent bond is formed between dye and cotton fiber under alkaline condition so alkali is added for fixation.
* Reactive dye reacts with water molecule to produce Hydrolysed dye.
* wide ranges of colours are available.
* Brilliant shades can be obtained.
* Good level dyeing can be obtained
* Moderate to good fastness properties can be obtained
* This dye can be applied to cotton, rayon, wool and silk fiber
* It can be applied to cellulosic fibers by the exhaust dyeing, semi continuous dyeing Continuous dyeing.

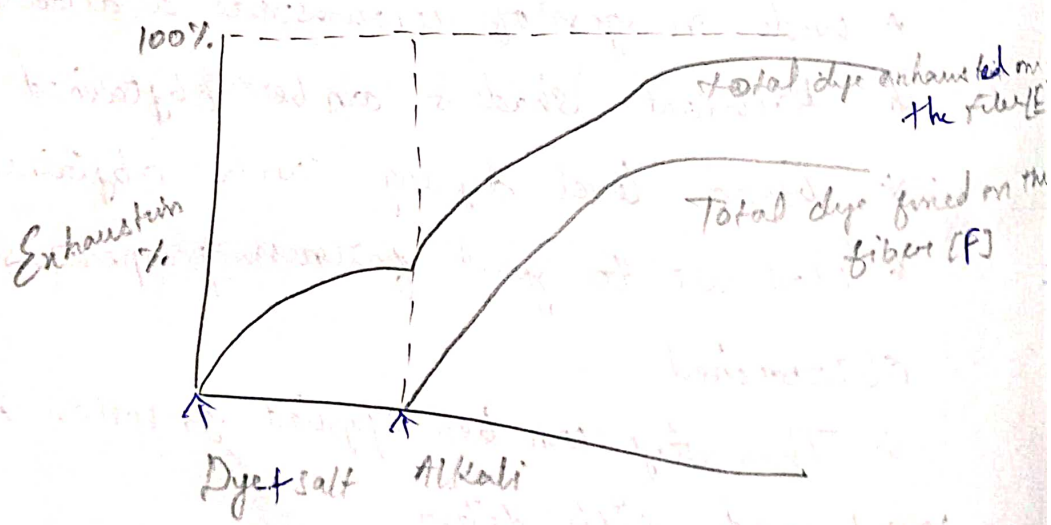
Classification of Reactive dye:

Reactive dyes can be classified into three types basically. They are,

* Alkali controllable dyes
* Salt controllable dyes
* Temperature controllable dyes

1. Alkali controllable dyes:

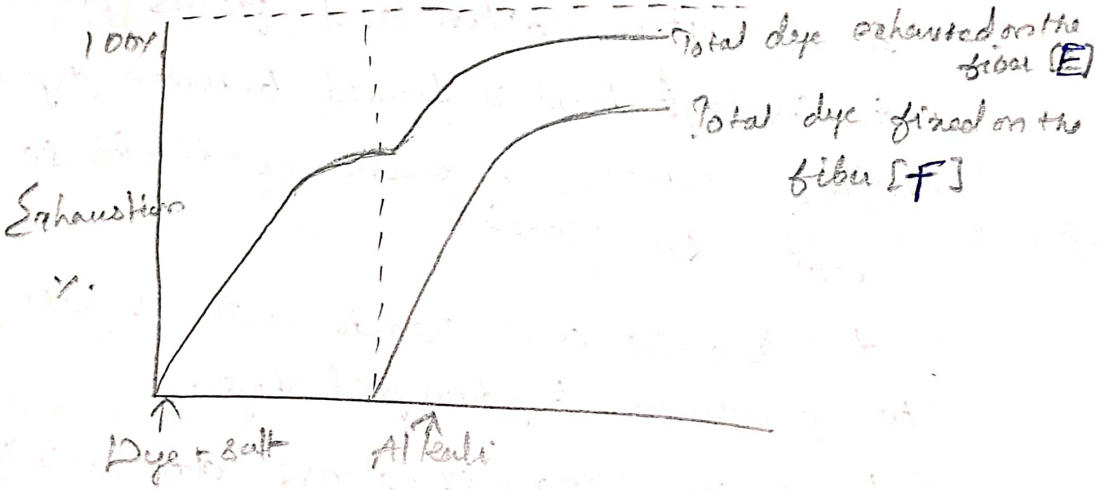
* Substantivity of the Alkali controllable reactive dye is low.
* For this dye the exhaustion [E] is very low by the addition of salt.
* But the exhaustion [E] increase very high when the alkali is added.
* Level dyeing can be obtained by the slow addition of alkali during dyeing.
* Exhaustion behaviour of alkali controllable dye is shown below.



2. Salt controllable dyes:

* Substantivity of the salt controllable reactive dye is medium to high

* for this dye the exhaustion [E] is very high dye by the addtion of salt.
* Slight increase in exhaustion [E] can be observed when the alkali is added.
* levels dyeing can be obtained by the slow or portion wise addition of salt during dyeing.
* Exhaustion behaviour of salt controllable dye is shown below.



3. Temperature controllable dyes:
* This dye is of self leveling dye type.
* These dayes react at temperature 80-100°c
* They can be dyed above boil temperature without the addtion of alkali.
* Level dyeing can be obtained by the gradual increase in temperature.

Machanism of Dyeing:
Adsorption, Enhaustion or Absorption / fination and ; after temperature
~~note: for absorption and Absorption defn.~~

~~previous unit~~

Cold Brand Reactive dye: (properties)

* Reactive system in this class of dye is Dichloro Triazine.

* Reactivity of this class of dye is very high so they can be dyes at room temperature

* Soluble in water.
* Salt is added to increase exhaustion
* By nucleophile substitution reaction, dyes react with cotton and forms covalent bond
* Covalent bond is formed between dye and cotton fiber under alkaline condition so Alkali is added for fixation

* Reactive dye reacts with water molecule to produced Hydrolysed dye.

* Wide ranges of colours are available.

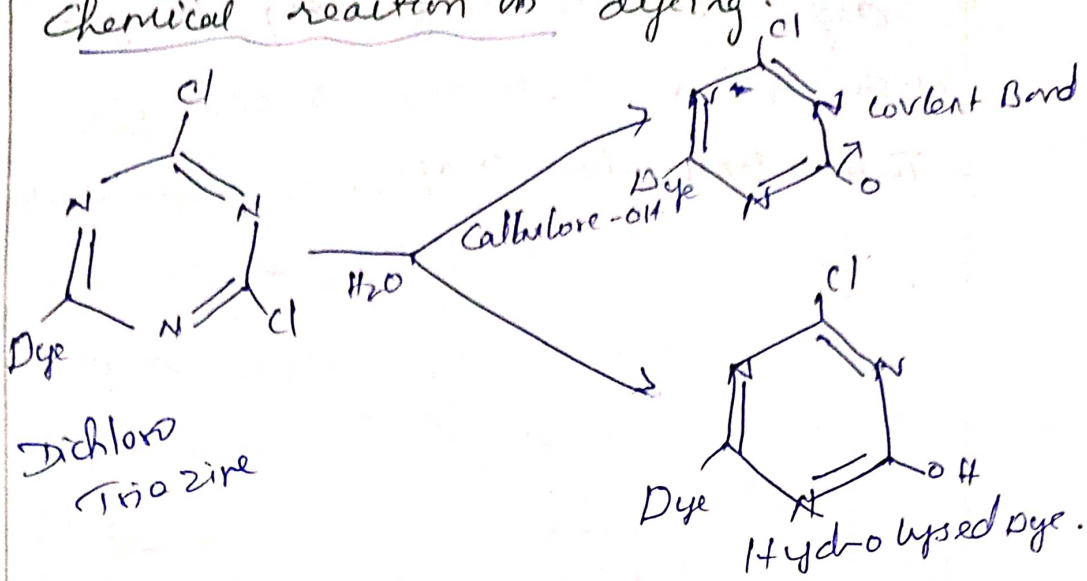
* Good level dyeing can be obtained.

* Moderate to good fastness properties can be obtained.

* This dye can be applied to cotton, ~~nylon~~. rayon, wool and silk fiber.

* Trade name for this class of dye is procion M [ICI] / Chemictive [Chemi Equip] Amar [Amar dye]

Chemical reaction of dyeing:



Exhaust Dyeing Recipe:

% Shade	Common salt (gpl)	Alkali (gpl)	
		Soda ash only	mixed alkali: Soda Ash + caustic Soda
up to 0.10	10	10	5 0.2
0.11 – 0.50	30	10	5 0.2
0.51 – 2.0	60	15	5 0.2 – 0.5
2.01 – 4.0	70	20	5 0.5
above 4.0	90	20	5 0.5

M:L Ratio : 1:20

Temp : 80°C

Time : 60-75 Mins

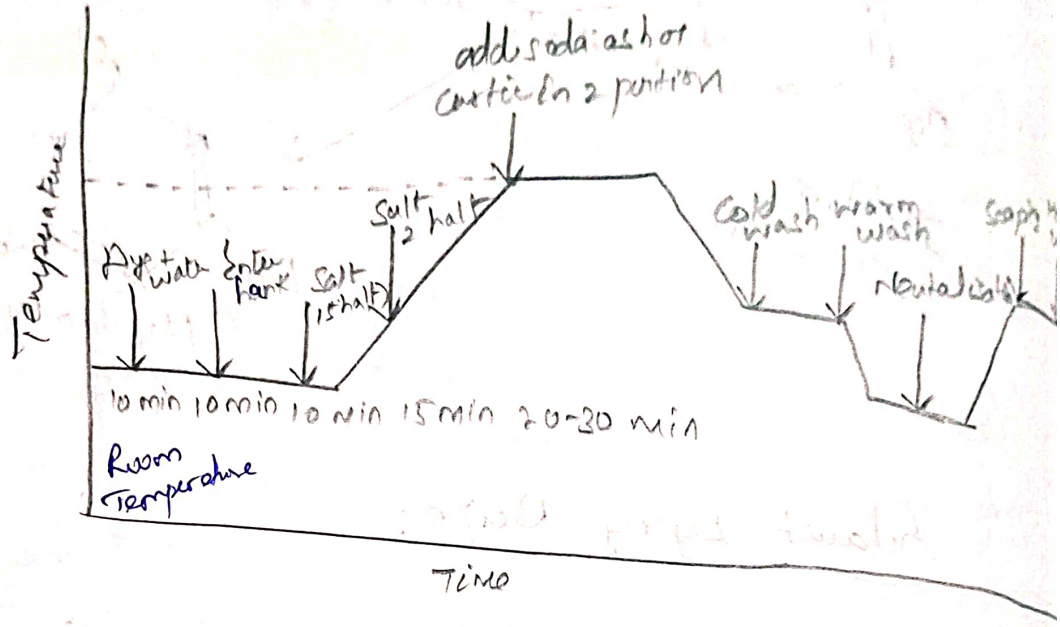
pH : 10.5-11.0

Preparation of Dye solution:

0.5 gm of hot brand reactive dyestuff is weighed accurately and pasted with small amount of urea and cold water. The paste is made up to 50 ml using hot water. Then the

dye solution is filtered, using the nylon mesh.

Time - temperature Graph:



Vinyl sulphone dye.

preparation.

* Reactive system in this class of dye is vinyl sulphon
* Reativity of this class of dye is in between cold & hot brand dye
* Dyed at 40 to 60 °C
* Soluble in water.
* Salt is add to increase exhaustion
* By nucleophilic addition reaction, dyes react with cotton and forms covalent bond.
* Covalent bond is formed between dye and cotton fiber under alkaline condition so Alkali add for fixation.
* Reactive dye react with water molecule to produce Hydrolysed dye.
* wide ranges of colour are available
* Good level dyeing can be obtained.

* Brilliant shades can be obtained
* Applicable for both dyeing and printing.
* Alkali fastness of this dye is low, so neutral soap is used while soaping.
* unfixed dyes can be washed off easily.
* Moderate to good fastness properties can be obtained.
* This dye can be applied to cotton, rayon, wool and silk fibers.
* Trade name for this class of dye is Remazol / Cavalite.

Chemical reaction in dyeing:

$D-SO_2-CH_2-CH_2-OSO_3Na$ — NaOH →

Sulphato Ethyl Sulphone dye

$D-SO_2-CH=CH_2 + Na_2SO_4$

Vinyl sulphone.

$D-SO_2-CH=CH_2 + cellulose-OH$ → $D-SO_2-CH=CH-O-cellulose$ (covalent bond)

$D-SO_2-CH=CH-OH$

Hydrolysed dye.

Exhaust Dyeing Recipe:

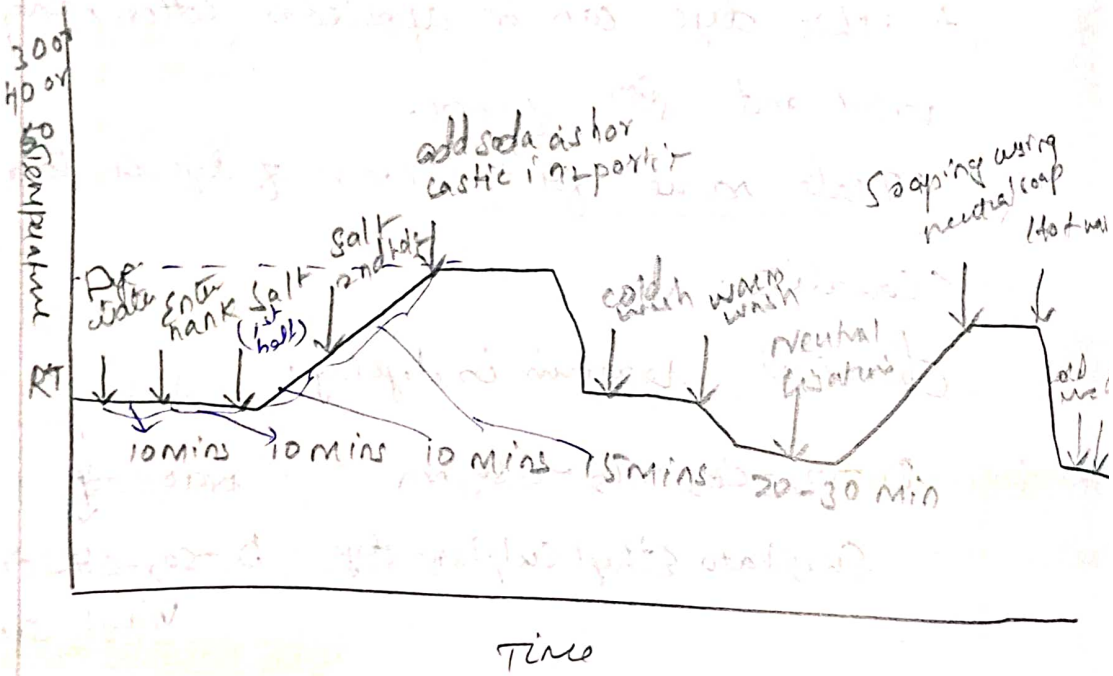
Temperature / Chemical	30°c	40°c	60°c
Glauber salt or common salt (gpl)	80-100	60-90	40-80
Caustic soda (TO TW) / soda Ash (gpl)	<2 % shade: 1	2	5
	2-4 shade: 2	3	8
	>4 shade: 5	5	5

M:L Ratio : 1:30
Time : 60 min
pH : 10.5 - 11.0

preparation of Dye solution:

0.5 gm of ramazol dyestuff is weighted accurately and pasted with small amount of urea and cold water. The paste is made up to 50 ml using hot water. Then the prepared dye solution is filtered using the Nylon mesh.

Time - temperature graph:



Bi functional dyes:

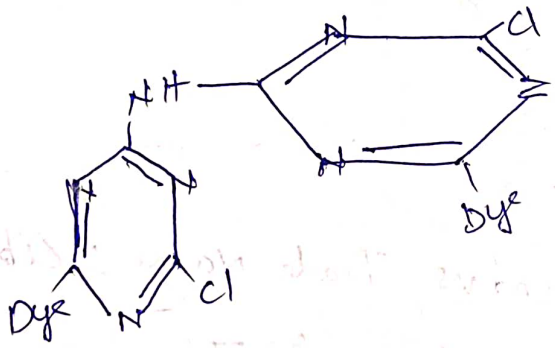
* This dye is manufactured by linking two reactive systems using Bridging groups
* Bi functional dyes are of two types
* They are,
  1. Homo Bi functional dyes.
  2. Hetro Bi functional dyes.

1, Homo Bi functional dyes.

* This dye is manufactured by linking similar reactive systems using bridging

groups.

* Substantivity is high and so exhaustion will be good.
* process conditions are based on the type of reactive systems selected.
* Dye - fiber bond is stable even in mild acidic condition.
* Homo Bi functional combinations are - Two MCT or Two DCT or Two VS.



MCT

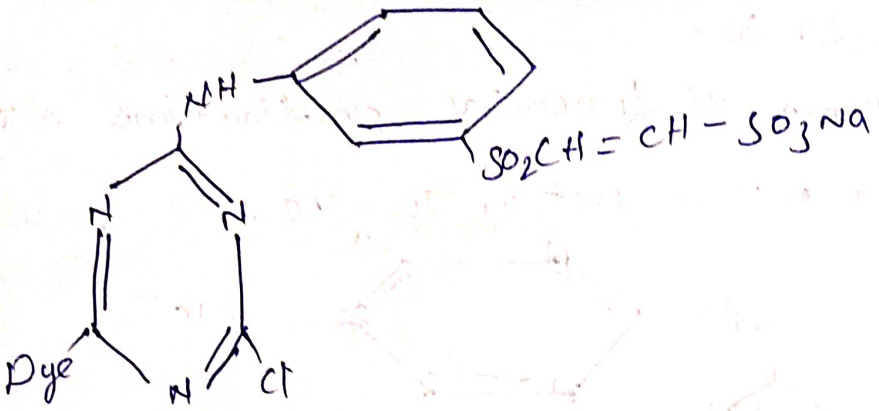
Eg: D Bis (Mono chloro Triazine)

Trade Name: procion HE

2. Hetro Bi functional dyes:

* This dye is manufactured by linking two different reactive systems being bridging group
* Level dyeing is obtained.
* Reactivity of this dye depends on the reactive system selected.
* Temperature of the dyeing depend upon the reactivity of the dye.
* Exhaustion and fixation good.

* Substantivity and is medium.
* Excellent migration properties
* Advantages of the both the system can be utilised by this dye.
* Hetro Bi functional Combinations are - MCT & DCT, MCT & VS, DCT & VS.

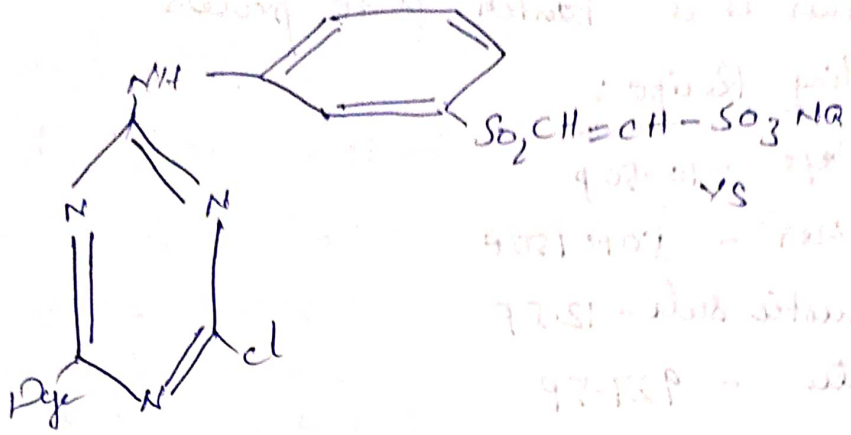


MCT

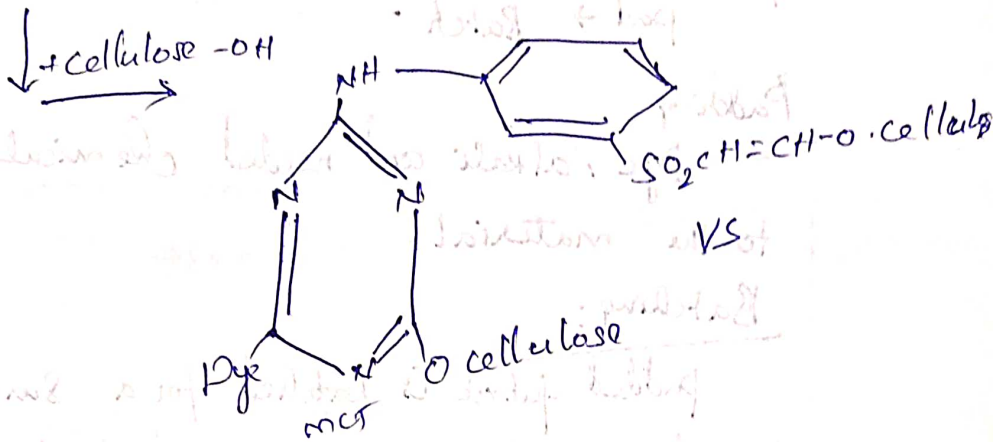
Eg: MCT and vs Trade Name: Cibracron HE.

HE [High Exhausation dyes]

* It is a Hetro Bi functional dye
* This dye is manufactured by linking two different reactive systems using bridging
* Excellent fixation can be acheived.
* Shades produced can be reproduced.
* Brilliant shades can be obtained.
* This dye is compatible with other dyeing chemicals
* Excellent migration properties.
* Level dyeing is obtained.



MCT



Exhaust Dyeing Recipe:

% Shade	common salt gpl	Alkali (gpl) Soda Ash only	Mixed Alkal Soda Ash + caustic soda
up to 0.10	10	5	0.2
0.11 – 0.30	20	5	0.2
0.31 – 0.5	30	5	0.2
0.5 – 1.0	45	5	0.2
1.0 – 2.0	60	5	0.2
2.0 – 4.0	70	5	0.2
above 4.0	90	5	0.2

M:L Ratio : 1 : 30 Time : 60 - 75 mins

Temperature : 70 - 80°C pH : 10.5 - 11.0

pad - Batch Method.

* This is a batch wise process

Padding Recipe:

Dye - 10-50 p

Urea - 50 to 150 F

Caustic soda - 12.5 F

water - 927.5 P

process:

pad → Batch.

Padding

Dye, alkali and needed chemicals are padded on to the material.

Batching:

padded fabric is batched for a surround of time according to the temperature, batching is types.

They are,

1) Cold Batch:

The padded fabric is batch beam and covered with a water proof meterial. Then the is slowly rotated for 24-48 hrs at room temperature, Then are washed, soaped, hot wash and then dried.

2) Hot Batch:

The padded fabric is batch beamand then covered with a water proof meterial. Then the is slowly rotated for 2-4 hrs in a Hot Steam Chamber at needed temperature Then are washed, soaped, washed and then dried.

Then the fabric is washed, soaped, hot wash and then dried.

pad - steam method:

This is a continuous process.

padding recipe

Dye - 10 to 50 p

Urea - 10 to 50 p

soda ash - 10 p

caustic soda - 10 p

water - 960 p

process:

pad → Dry → Steam.

padding:

Dye, alkali and needed chemical are padded on to the material.

Drying:

The padded fabric is dried in the IR Infra Red heater at 100°c for 2-3 mins.

Steaming:

The dried fabric is steamed in a steamer at 110° - 115°C for 5 mins Then the fabric is washed, Soaping, hot washed and then dried.

pad - cure method:

This is a continued process.

padding recipe:

Dye - 10 to 50 p

Urea - 50 to 150 p

Soda ash - 10g
caustic soda - 10g
water - 920g

process :
pad → Dry → cure

padding :
Dye, alkali and needed chemicals are padded on to the chemical.

Drying :
The padded fabric is dried in a heater at 100°C for 2-3 mins

curing :
The dried fabric is cured in a curing chamber at 120 - 150° C for 3 mins Then the fabric is washed, soaped, hot wash and then dried.

pad - silicat method.
This is a batch wise process

process :
pad → Dry → pad (silicate)

padding :
The fabric is padded with the required dye solution.

Drying :
The padded fabric is dried at 100°C for 2-3 mins in a IR drier.

padding : [silicate]

The dried fabric is again padded with the silicate at 106°TW, According to the temperature of this method is classified into two types they are,

1) Cold batch :

The silicate padded at room temp and then batched in a beam and then covered with water proof material Then the beam is slowly rotated for 18-20 hrs at room temperature. Then are washed and hot washed and then dried.

2) Hot batch :

The silicate padded at hot temp and then batched in a beam and then covered with water proff material. Then the beam is slowly rotated for 1-2 hrs at room temp. then are washed and hot washed and soaping then dried.

Then the fabric is washed, soaped, hot washed and then dried.