

# Master Training Program on Water (Water Supply, In-house Processing, End-of-Pipe) in Textile and Garment factories

Promotion of Sustainability in the Textile and Garment Industry in Asia - FABRIC

Day 5: Presentation 2

# Garments dyeing/washing

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## Contents

- Garment Washing and Garment Dyeing
  - Wet process vs dry process
- The technique and procedure
- Garment washing/dyeing machine
- New development

## **Garment Dyeing/Overdyeing**

- Pretreated (aka bleached) Garment
- Semi-finished Garment
- Garment overdyeing

## **Garment Washing**

- Panel form
- Full garment form
- Washing and dyeing together

# Form of Garment dyeing/washing

## **Wet Process**

- Full Garment washing (e.g. Denim, T-shirt, Gaberdine etc.)
- Garment washing + dyeing+ finishing
- Garment washing and finishing
- .....

## **Dry process**

- Ozone/laser jet
- Potassium permanganate
- .....

# Garment dyeing/washing



Source: Reed Consultancy 2016

# Garment dyeing/washing



Source: Reed Consultancy 2016

# Wet Processing

- Desizing
- Wash (mainly on denim but can be on knit and woven)
  - ✓ Stone wash
  - ✓ Enzyme washing and biowashing
  - ✓ Acid wash effect
  - ✓ Caustic Wash
  - ✓ Super White Wash
  - ✓ Bleach wash
- Spray and pulverizing effect
- Tie effects
- Tinting on garment



# Dry Processing

- Grinding
- Tagging & clipping
- Damages and breaks
- 3D effects with resin applications
- Patch and repair
- Laser effects
- Ozone effect

## Garment washing/dyeing machine – wet process

- Sample washing machine (Horizontal or vertical)
- Washing machine (Front loading/ top loading machine)
- Belly washers
- Steam chamber for crinkle
- Hydroextractor machine
- Spray gun and dummy

# Garment washing/dyeing machine – wet process

Side loading Garment washing machine



Copyright: Reed Consultancy (2017)

# Garment washing/dyeing machine – wet process

## Side loading Garment washing machine

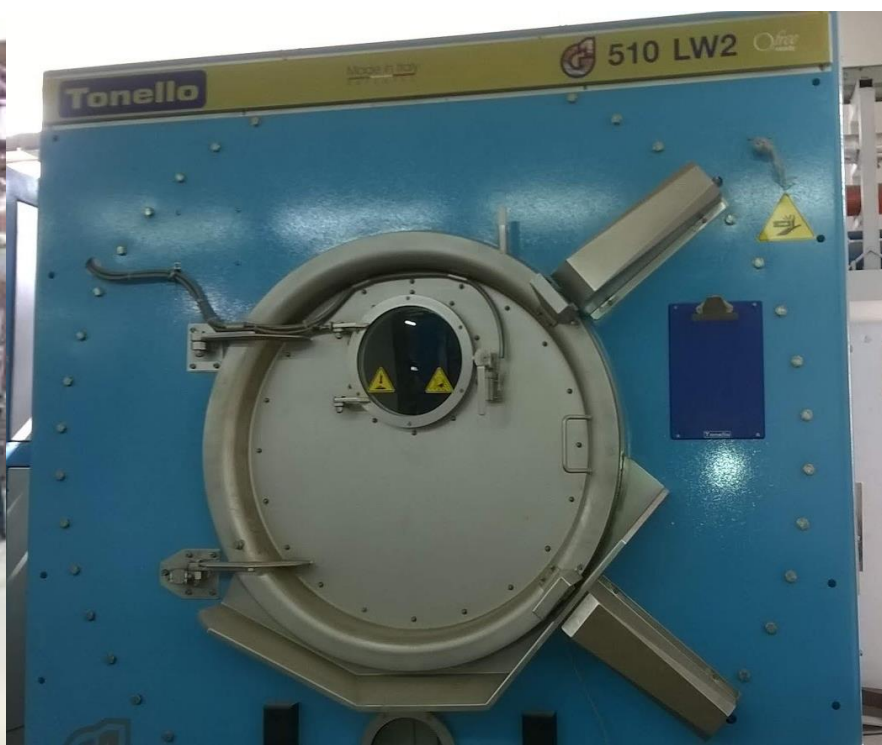


Copyright: Reed Consultancy (2017)



# Garment washing/dyeing machine – wet process

## Front Loading Garment Washing machine



Copyright: Reed Consultancy (2016)

# Garment washing/dyeing machine – wet process

## Front Loading Garment Washing machine



# Garment washing/dyeing machine – wet process

## Hydroextractor



# Garment washing/dyeing machine – wet process

## Dryer

Dryers are two type –

- Gas dryer : Rapid drying action.
- Steam dryer : optimum temperature controlled dryer.





# Garment washing/dyeing machine – wet process

Oven/Curing machine and PP Spray



PP Spray Machine :



# Chemical used in wet process

- Desizing agent
- Detergent
- Salt (sodium chloride)
- Acetic acid and Buffer
- Hydrogen peroxide/ Bleaching powder
- Stabilizer
- Sodium hyposulfite/Sodium metabisulphite
- Fixing agent
- Caustic soda/Soda ash/Sodium bicarbonate
- Enzyme
- Antistain agent
- Cationizer
- Resin
- Potassium permanganate
- Cationic / Nonionic softener
- Microemulsion silicon
- Optical brightener



# Garment Washing

# Garment Washing

## Floor with Side loading machine



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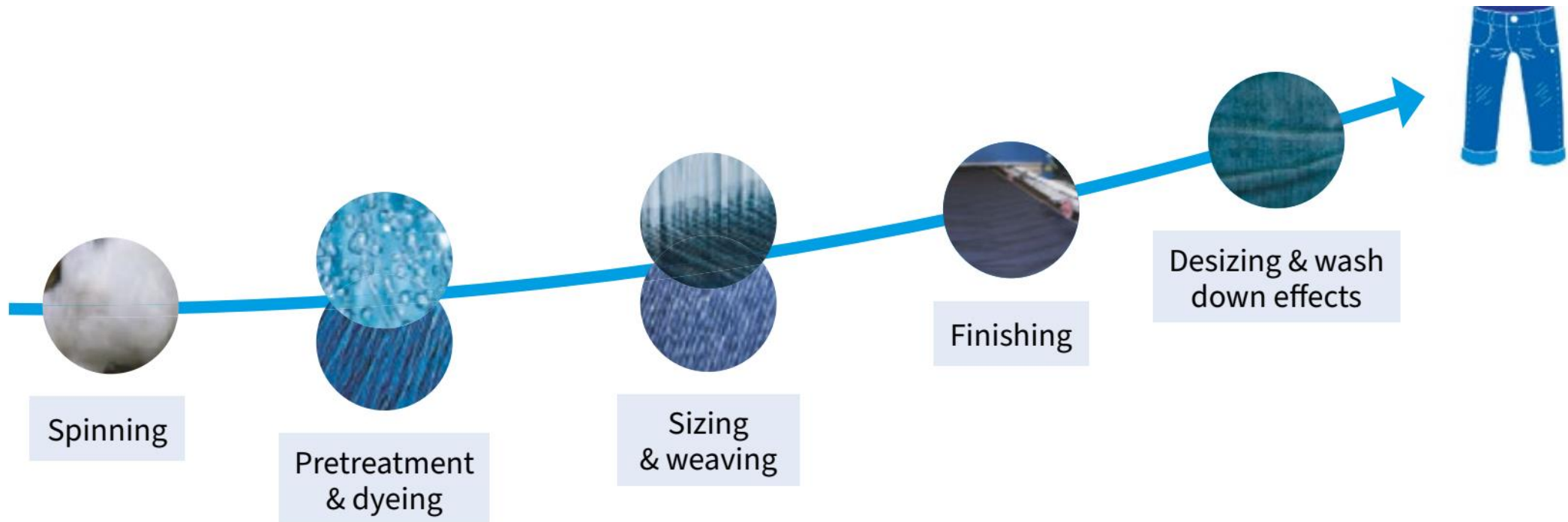
## Garment Washing floor – Front loading machine



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# Garment Washing

## Process of Denim Wash



# Garment Washing

## Basics

- Garment can be made by measurement spec but washing gives an aesthetic and attractive look in it.
- Washing includes but not limited to shade, dry process, dyeing and processes according to the requirement.
- Although perception is there are separate kinds of washing such as Enzyme wash, Softener wash, Bleach wash, Stone wash, Silicon wash, however, in reality washing combines these all or partially.

# Denim washing processes

## 1. Washing

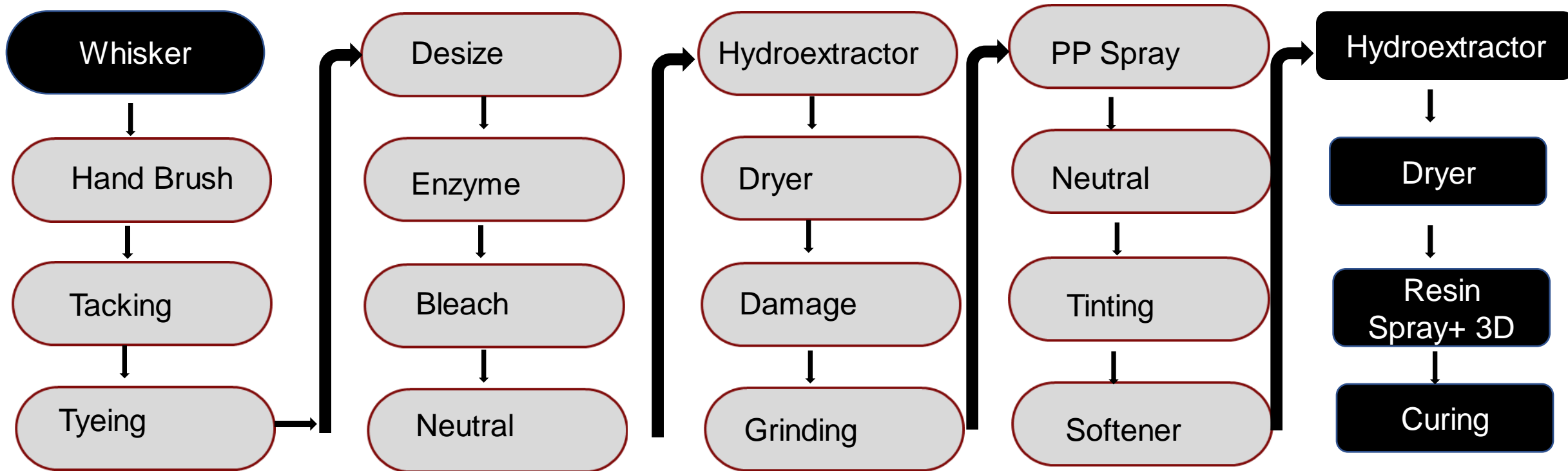
- Chemical washing
- Rinse wash
- Enzyme wash
- Stone wash

## 2. Tinting and dyeing

## 3. Softening



# Flow chart of Denim Washing



# Recipe and steps of Enzyme wash

Steps	Name of chemicals or product used	Dosage/Quantity
<b>1<sup>st</sup> Step Desizing</b>	Lot size (Twill/canvas garment)	60 kg
	Add water L : R = 1 : 10	600 Liter
	Machine running.	
	Add desizing agent (0.6 gm / liter)	360 gm
	Add detergent (0.5 gm / liter)	300 gm
	Temperature	50 °c
	Time	10 to 20 min
	Drop the liquor.	
	Rinse one time	3 min
	<b>2<sup>nd</sup> Step Enzyme</b>	Add water ( L : R = 1 : 8 )
Temperature		45 °c
Add acetic acid (0.5 gm / liter)		240 gm
Add acid enzyme (1.2 gm / liter)		576 gm
Add antistain (0.50 gm / liter)		240 gm
Time (Depend upon the standard)		30 to 60 min
Increase temperature to 90 °c and run 1 minute.		
Drain the bath.		
Rinse twice, each 3 min.		

<b>3<sup>rd</sup> Step Softening</b>	Add water (L : R = 1 : 8)	480 liters
	Add acetic acid (0.6 gm / liter)	288 gm
	Cationic softener (1 gm / liter)	480 gm
	Silicon (ME) (0.5 gm / liter)	240 gm
	Temperature	40 °c
	Time	15 to 20 min
	Drain the bath.	
Then unload the garments on trolley.		
<b>4<sup>th</sup> Step Hydro extracting</b>	To remove excess water from the garment by using hydro extractor machine.	
<b>5<sup>th</sup> Step Drying (Steam or Gas dryer)</b>	Load garments to gas/steam dryer	60 kg
	Temperature set	75 °c to 85 °c
	Run about 35 to 45 min.	
After run 10 to 15 minutes for cold dryer.		
<b>6<sup>th</sup> Step Quality check</b>	After dryer garment go to quality section for quality checking and then delivery.	

Source: <https://core.ac.uk/download/pdf/286338405.pdf>

# Recipe and steps of Stone wash

<b>Desizing</b>	Add water (L: R = 1 : 9)	540 liters
	Start the machine.	
	Temperature	60 °c
	Add desizing agent (0.6 gm / liter)	324 gm
	Add detergent (Antistain) (1 gm / liter)	540 gm
	Time	15 to 25 min
	Drop the liquor.	
<b>2<sup>nd</sup> step Hot wash</b>	Add water (L: R = 1 : 9)	540 liters
	Temperature	60 °c
	Time	5 min
<b>3<sup>rd</sup> Step Bleaching</b>	Add water (L : R = 1 : 8 )	480 liters
	Machine running.	
	Add bleaching powder (k.c.i) (10 gm/liter)	4800 gm
	Add soda ash (5 gm/liter)	2400 gm
	Pumic stone ½ volume of garments.	
	Temperature	60 °c
	Time (Depend upon the shade)	12 to 15 min
	Drop the liquor.	
	Rinse twice, each 3 minutes.	
	<b>4<sup>th</sup> Step Neutralization</b>	Add water( L: R = 1: 9)
Add sodium hyposulphite (3 gm/litre)		1620 gm
Temperature		40 °c.
Time (Depend upon the shade)		10 to 12 min
Drop the liquor.		
Rinse one		
<b>5<sup>th</sup> Step Softening</b>	Add water (L: R = 1: 8)	480 liters
	Add Acetic Acid (0.6 gm/liter)	288 gm
	Cationic softener (1gm/liter)	480 gm
	Time	5 min
	Temperature	40 °c
Drop the liquor.		
Unload the garments to trolley.		
<b>6<sup>th</sup> Step Hydro extracting</b>	To remove excess water from the garment by using hydro extractor machine.	
<b>7<sup>th</sup> Step Drying</b>	Load garments on dryer	40 kg
	Temperature	75 °c to 85 °c
	Time	35 to 40 min and 10 minutes in cold dry.
<b>8<sup>th</sup> Step Quality check</b>	After quality checking garment will be delivery.	

Source: <https://core.ac.uk/download/pdf/286338405.pdf>

# Actual wash recipe

BUYER		Petrol	DATE		11/00/2016					
GARMENT TYPE		Shalwar - 2	WEIGHT							
STYLE		SAME + Final	LOAD/LOT							
RECIPE TYPE			MACHINE TYPE							
GENERAL PROCEDURE										
WET PROCESS			DRY PROCESS							
1	Desizing		1	Washed						
2			2	H/B						
3	E/W		3	TIA Rinse						
4	Bleach		4	BP - Spal						
5	Neutral		5							
6	BP - Neutral		6	3P						
7	Tint		7							
8			8							
VARIABLES										
STEP	PROCESS	WATER RETO	WATER LTR	TIME MIN	TEMP C	PH	CHEMICAL	DOSAGE	UNIT	REMARKS
01	Desizing		600	10 min	40°C		DSO PKL	800 800	g/L g/L	
	Rinse		1000	4 min			GOI	300	g/L	
02	E/W		500	30	45°C		S PKL Acid	800 600 80	g/L g/L g/L	
	Rinse		1000	4 min						
03	Bleach		800	10 min	45°C		Bleach	800	g/L	
	Rinse		1000	4						
04	Neutral		500	10 min	40°C		Mala PKL	800 400	g/L g/L	
	Rinse		1000	3 min						2nd = 100%
05	Neutral									
05	Bleach		800	5	40°C		Bleach	300	g/L	
	Rinse		1000	3						
06	Neutral		600	8 min	40°C		Mala PKL	800 300	g/L g/L	
	Rinse		1000	4						
07	Tint		400	5	40°C		Glt Kl Salt	5.00 1.00 500	g/L g/L g/L	

Source: Reed Consultancy 2016

# Tinting

Partially dyeing is known as tinting. The faded area and to give a dirty stylish look tinting process is used. Mainly direct dyes are used for this process because of the easy coloration and de-coloration facility

## Stone wash

- Pumice Stone: There is a trend of using stone which is called Pumice stone, these stones are collected after volcanic explosion, these stones are light as sometimes it floats on water. Mainly it is kind of hollow inner portion.
- Two types –
  - Indonesian (kind of blackish) &
  - Turkish (mostly used and effective more, more white)



Stonewashed garment source: Reed Consultancy 2015

# Garment Washing – Acid wash with $\text{KMnO}_4$



# PP Spray



Source: Reed Consultancy 2016



# PP Spray



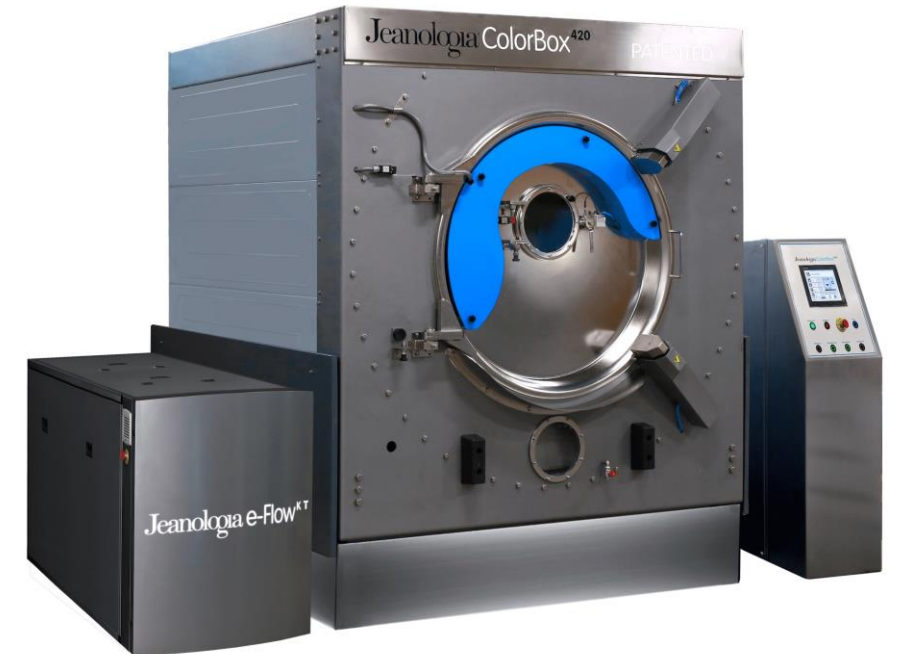
Source: Reed Consultancy 2016

# Dryer



# Nanobubble technology

- technology that claims to reduce water and chemical usage by 60 percent and energy by 45 percent
- very low liquor ratios (1:2-1:4)
- nanobubbles, which uses air instead of water for certain steps of the process
- uses automated digital solutions to ensure accurate processes to improve RFT
- can be applied to all types of garments made with cotton, lyocell, linen, polyamide, elastane, silk and wool



# Garment Dyeing

# Garments Dyeing

The process of dyeing fully made apparel products like t-shirts, pants, trousers, shirts, jackets, tops, pullovers, hosiery, and bottoms is called garments dyeing



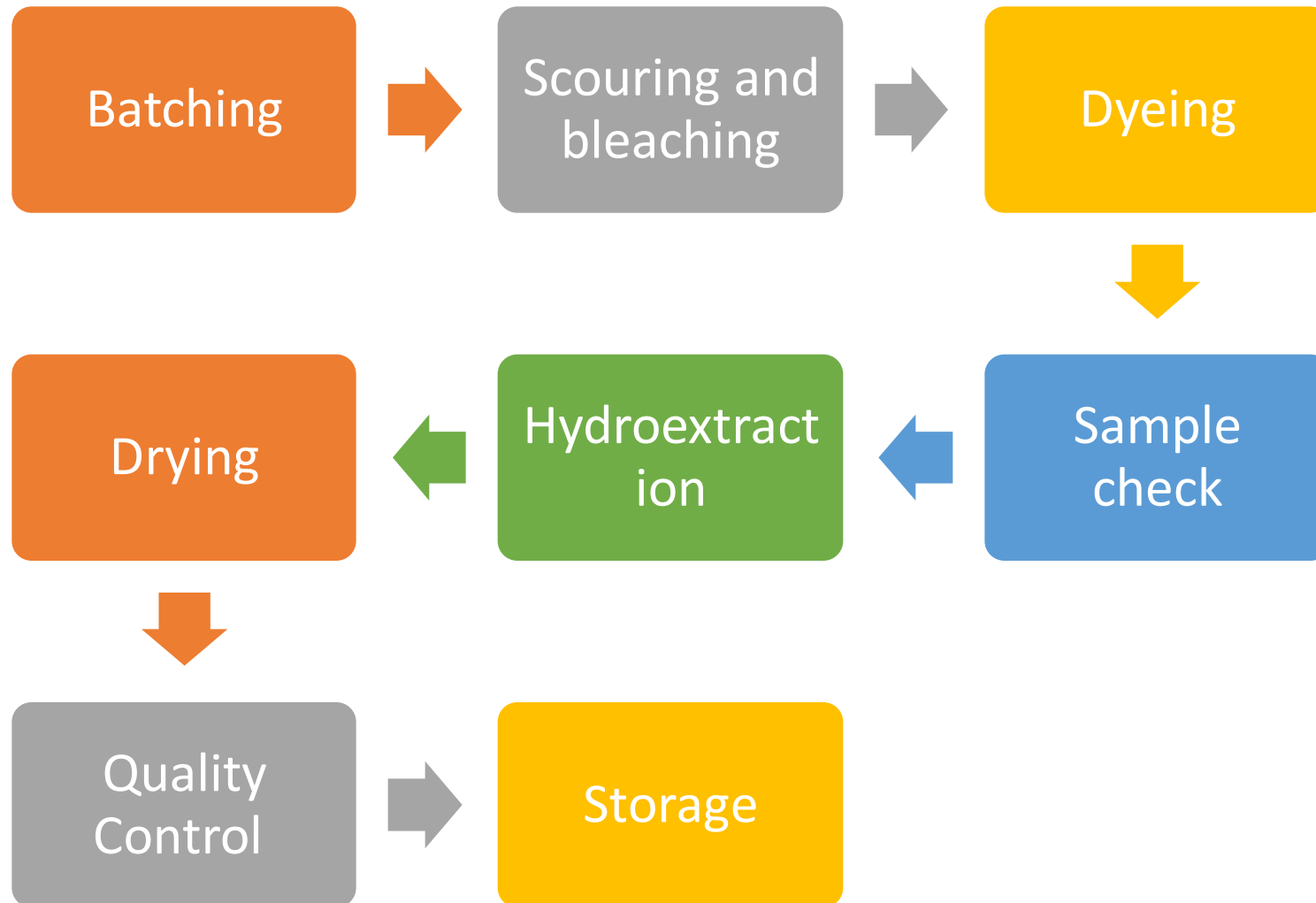
# Advantages of Garments Dyeing

- Comparatively lower cost of production for any item of any color and shade
- No possibility of shade variation within the garments
- Small lots of different items could be dyed at a lower cost within less time
- Old garments could be re-dyed, hence becoming like new garments.
- Comparatively lower capital investment in a garment project.
- During fabric cutting about 15% of the fabric is wasted, garment dyeing can reduce the dyeing cost of that 15% of the fabric.

## Some disadvantages:

- Labour intensive process and requires thorough checking of every piece
- Poor reproducibility of shades
- Special care in the selection of fittings
- More material handling

# Process flow of garments dyeing



# Dyes used in Garments Dyeing

## Direct Dyes

- Washable

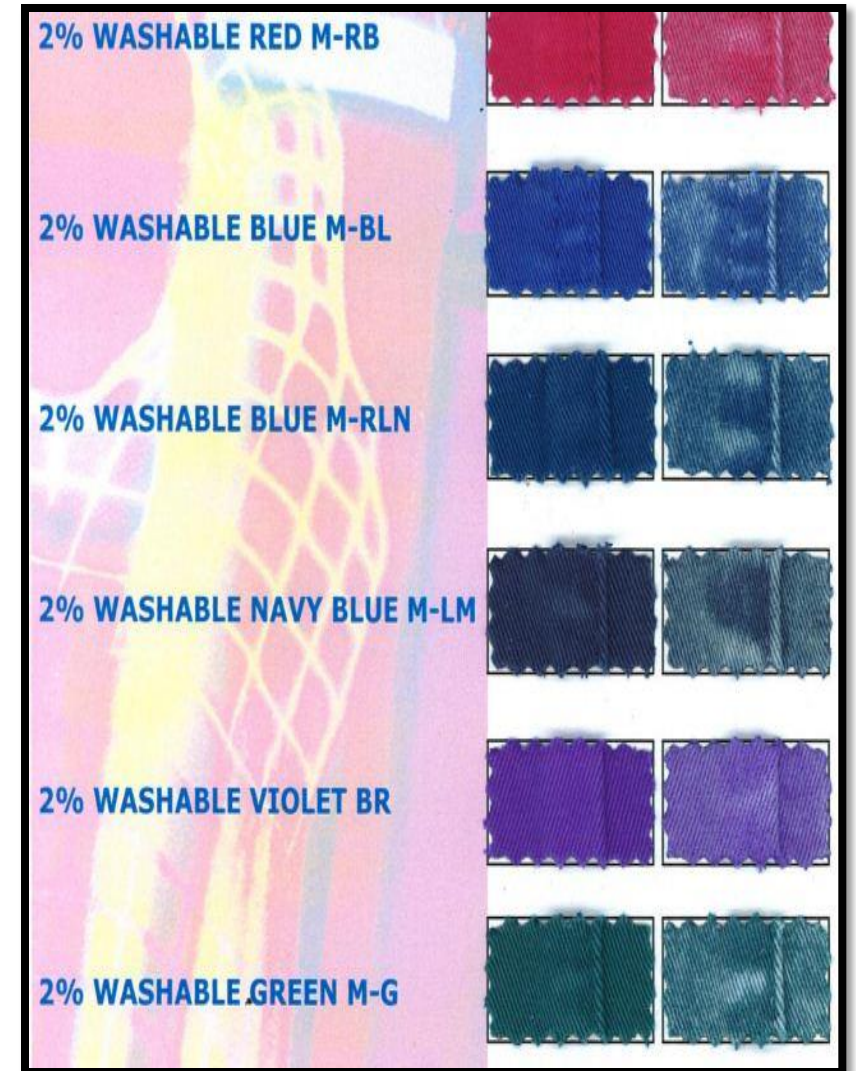
## Reactive Dyes

- Dischargeable

## Sulphur Dyes –e.g. sulfotex

## Pigments

- Indigo
- Sulphur black





# Dyes used in Garments Dyeing

## Reactive vs Direct Dye



# Dyes used in Garments Dyeing

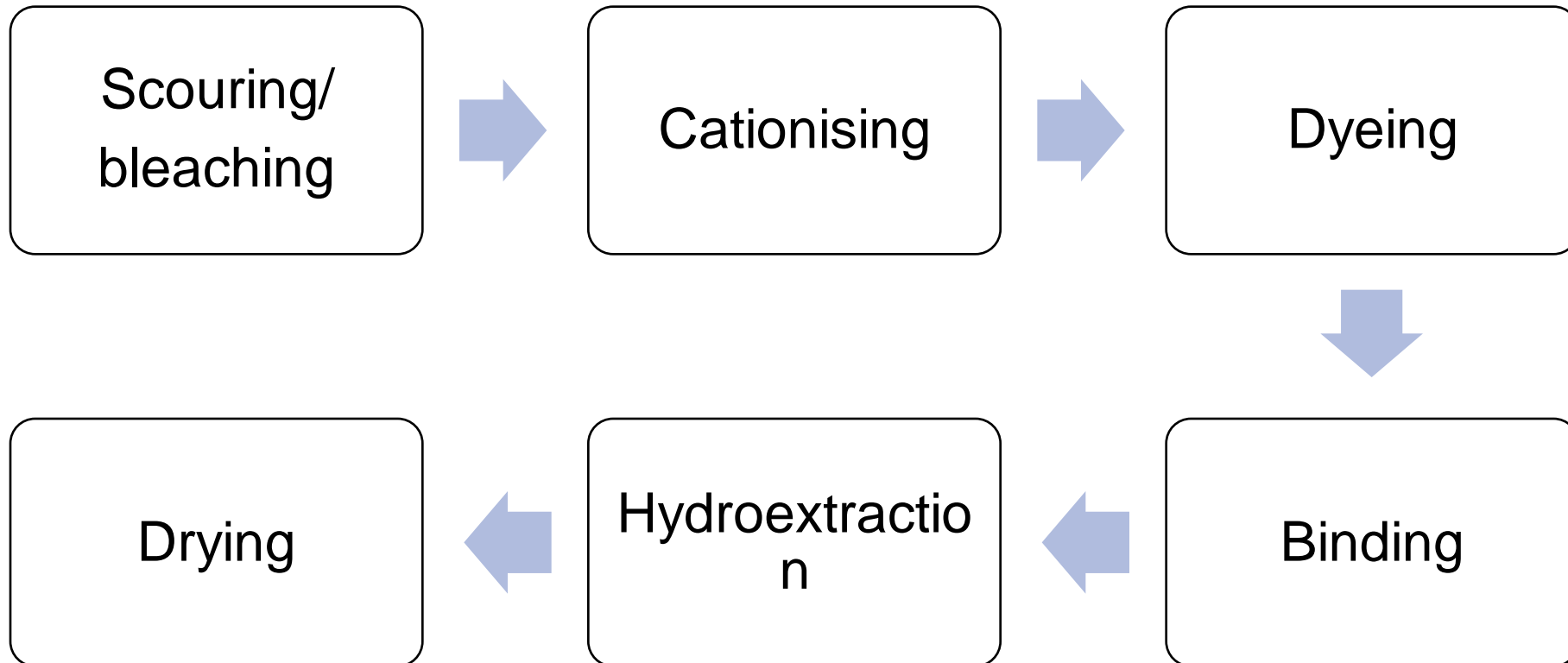
## Pigment dyeing

- Cationisation of cotton garment
- Pigment dyeing
- Washing



# Dyes used in Garments Dyeing

## Pigment dyeing



# Process optimisation

## **Use green chemistry**

- aniline-free\* indigo for denim

## **Low liquor ratio machine**

## **Monitor process parameters**

# New Development

# New Technology

## **Adidas' DryDye garment dyeing**

- ✓ uses pressurized CO<sub>2</sub> to dye t-shirts and other garments
- ✓ Claimed no water; 50 percent less energy and 50 percent fewer chemicals

## **AirDye**

- ✓ The patented process system adds PVC-free inks to a paper carrier, then heat-transfers the dyes from the paper to the surface of the fibers at a molecular level.
- ✓ Claimed 90 percent less water and 85 percent less energy

## **Jeanologia's E-Soft technology**

- ✓ transforms air in the atmosphere into “nano-bubbles” that soften fabrics
- ✓ Claims using 98 percent less water and 79 percent less energy than traditional methods

# New Technology

## Laserjet technology



## Reference

- Garment Washing Techniques for Cotton Apparel <https://www.cottoninc.com/wp-content/uploads/2017/12/TRI-3005-Garment-Washing-Techniques-for-Cotton-Apparel.pdf>
- Effective Mechanical and Chemical Washing Process in Garment Industries <https://core.ac.uk/download/pdf/286338405.pdf>



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