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

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

FABRIC Asia

Day 5: **Presentation 2**

Garments dyeing/washing

Mohammad Abbas Uddin Shiyak, PhD, CText FTI
Assistant Professor and Head
Department of Dyes and Chemical Engineering
Bangladesh University of Textiles

Md Anwarul Islam, MSc
Consultant, Reed Consultancy

Outlines

Contents

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

Conceptual framework

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

Garment dyeing/washing

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

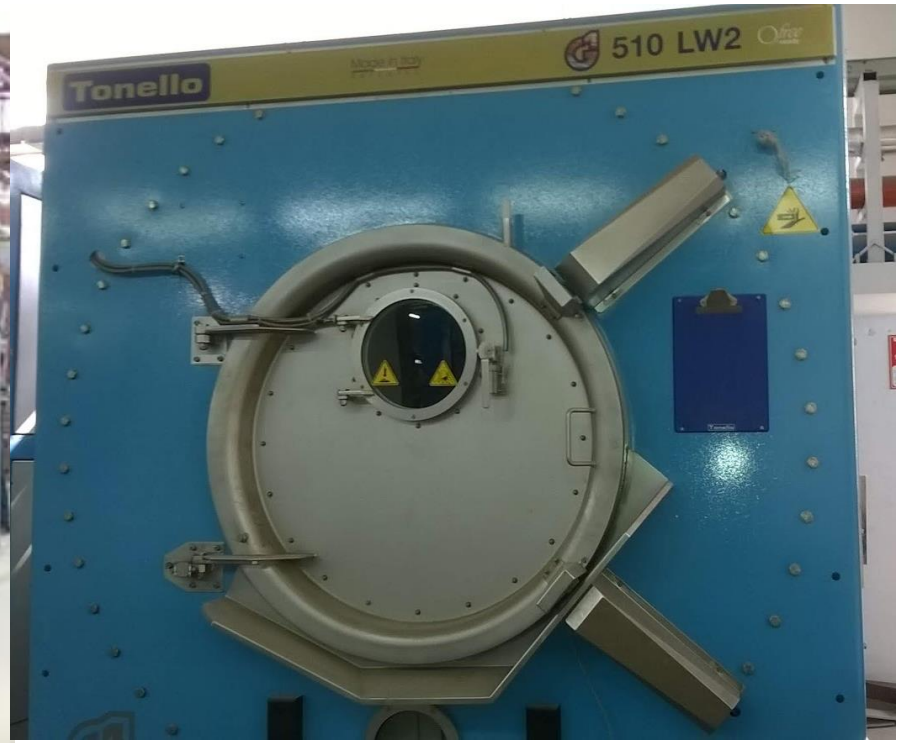
Side loading Garment washing machine

Garment washing/dyeing machine – wet process

Side loading Garment washing machine

Garment washing/dyeing machine – wet process

Front Loading Garment Washing machine



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

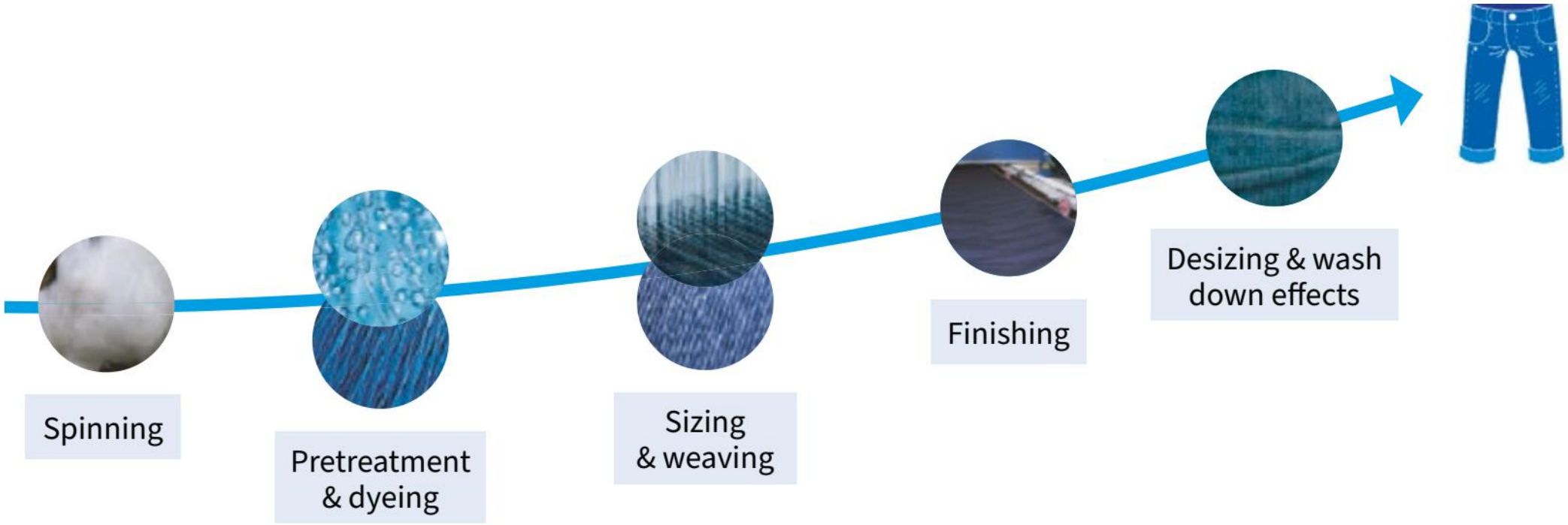
Floor with Side loading machine

Garment Washing

Garment Washing floor – Front loading machine

Garment Washing

Process of Denim Wash



Garment Washing

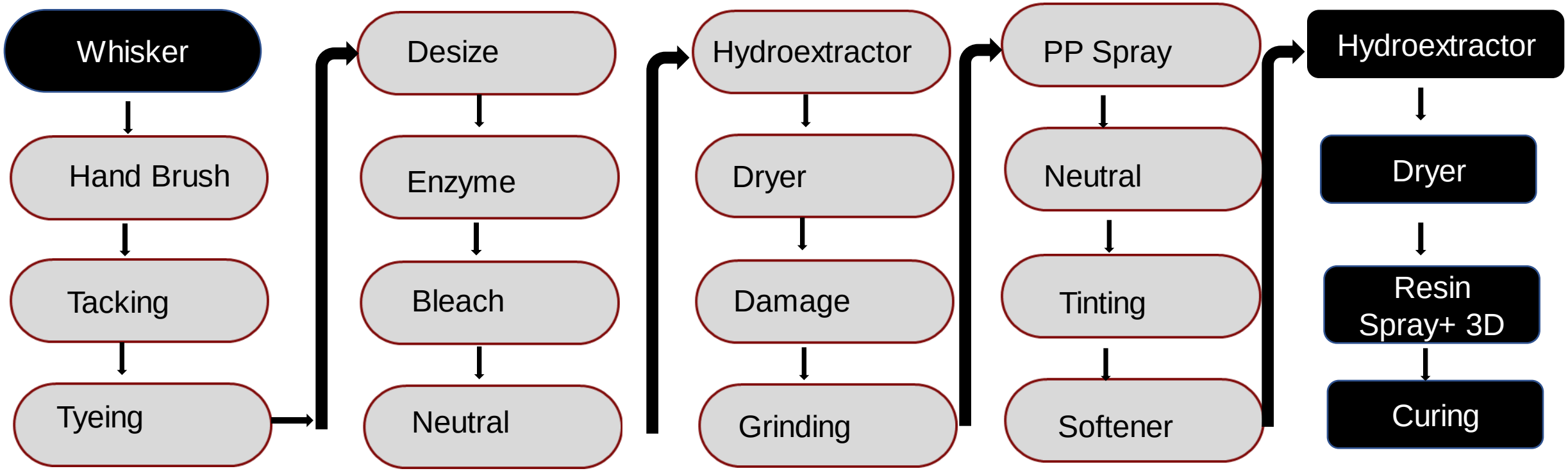
Basics

- 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
1st Step Desizing	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 ℃
	Time	10 to 20 min
	Drop the liquor.	
	Rinse one time	3 min
2nd Step Enzyme	Add water (L : R = 1 : 8)	480 liter
	Temperature	45 ℃
	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 ℃ and run 1 minute.	
	Drain the bath.	
	Rinse twice, each 3 min.	
3rd Step Softening	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 ℃
	Time	15 to 20 min
	Drain the bath.	
	Then unload the garments on trolley.	
4th Step Hydro extracting	To remove excess water from the garment by using hydro extractor machine.	
5th Step Drying (Steam or Gas dryer)	Load garments to gas/steam dryer	60 kg
	Temperature set	75 ℃ to 85 ℃
	Run about 35 to 45 min.	
	After run 10 to 15 minutes for cold dryer.	
6th Step Quality check	After dryer garment go to quality section for quality checking and then delivery.	

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

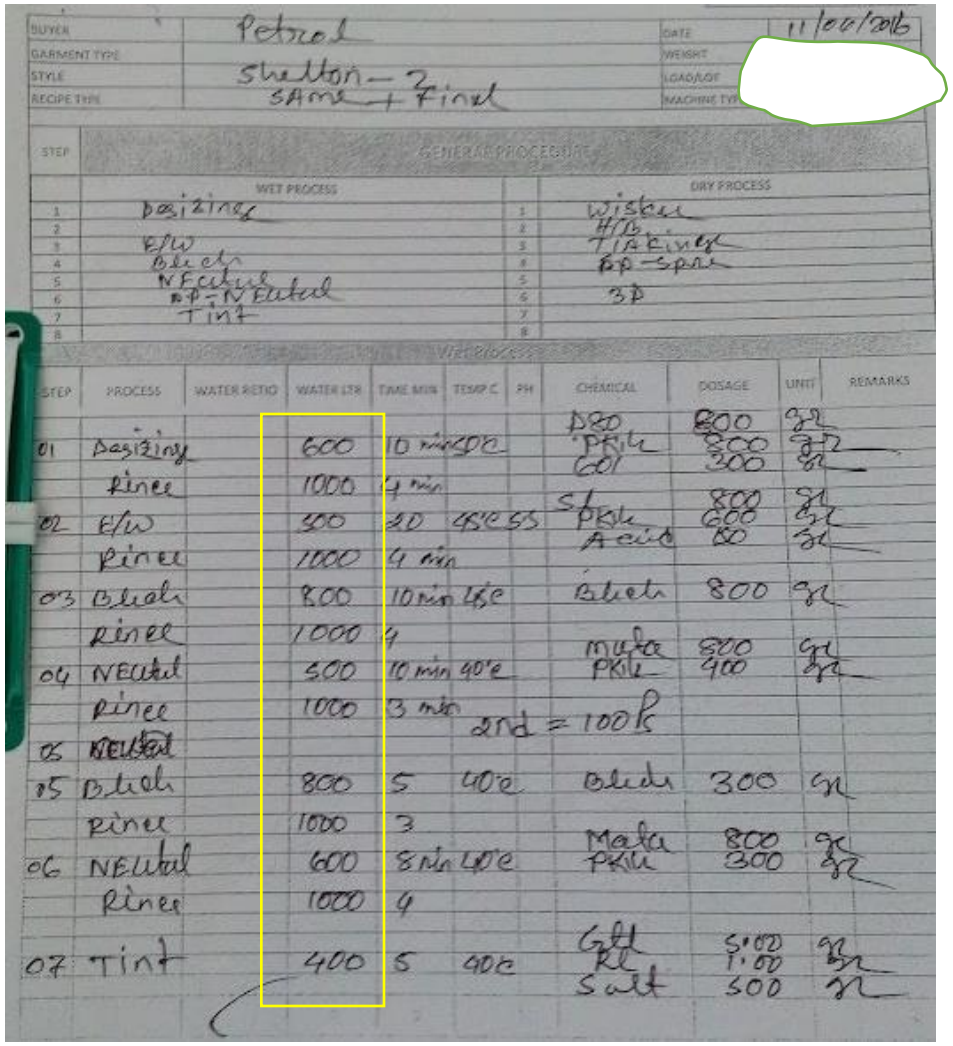
Recipe and steps of Stone wash

Desizing	Add water (L: R = 1 : 9)	540 liters
	Start the machine.	
	Temperature	60 ℃
	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.	
2nd step Hot wash	Add water (L: R = 1: 9)	540 liters
	Temperature	60 ℃
	Time	5 min
3rd Step Bleaching	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 ℃
	Time (Depend upon the shade)	12 to 15 min
	Drop the liquor.	
	Rinse twice, each 3 minutes.	

4th Step Neutralization	Add water(L: R = 1: 9)	540 liters
	Add sodium hyposulphite (3 gm/litre)	1620 gm
	Temperature	40 ℃.
	Time (Depend upon the shade)	10 to 12 min
	Drop the liquor.	
	Rinse one	
5th Step Softening	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 ℃
	Drop the liquor.	
	Unload the garments to trolley.	
6th Step Hydro extracting	To remove excess water from the garment by using hydro extractor machine.	
7th Step Drying	Load garments on dryer	40 kg
	Temperature	75 ℃ to 85 ℃
	Time	35 to 40 min and 10 minutes in cold dry.
8th Step Quality check	After quality checking garment will be delivery.	

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

Actual wash recipe



STEP	PROCESS	WATER RETIO	WATER LTR	TIME MIN	TEMP C	PH	CHEMICAL	DOSAGE	UNIT	REMARKS
01	Dasizing		600	10 min	50c		DSO	600	gr	
							PRIL	800	gr	
							GOI	300	gr	
	Rinse		1000	4 min						
02	E/W		300	20	45c	5.5	PRIL	800	gr	
							Acid	600	gr	
	Rinse		1000	4 min				80	ml	
03	Bleach		800	10 min	45c		Bleach	800	gr	
	Rinse		1000	4						
04	Neutral		500	10 min	40c		Mafa	800	gr	
	Rinse		1000	3 min			PRIL	400	gr	
				2nd = 100 L						
05	Neutral									
05	Bleach		800	5	40c		Bleach	300	gr	
	Rinse		1000	3						
06	Neutral		600	8 Min	40c		Mafa	800	gr	
	Rinse		1000	4			PRIL	300	gr	
07	Tint		400	5	40c		Glt	5'00	gr	
							RL	1'00	gr	
							Salt	500	gr	

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 KMnO4

PP Spray

Source: Reed Consultancy 2016

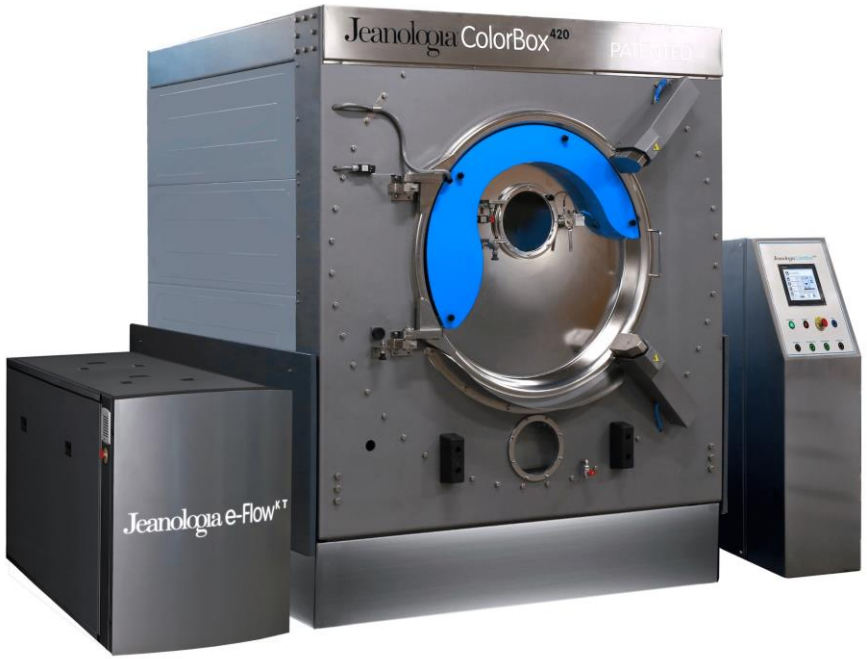
PP Spray

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, hosieries, and bottoms is called garments dyeing

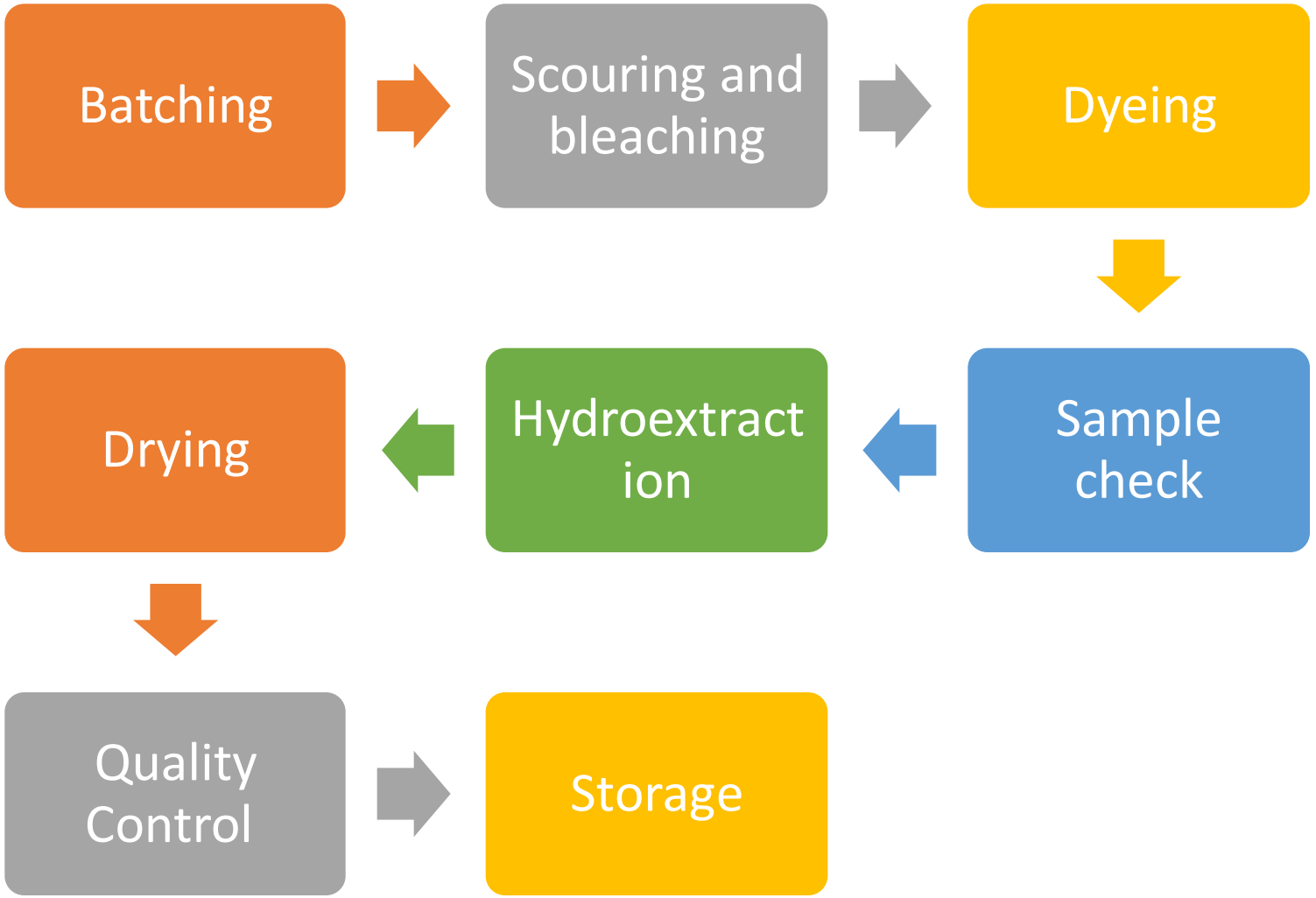
Advantages of Garments Dyeing

- 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

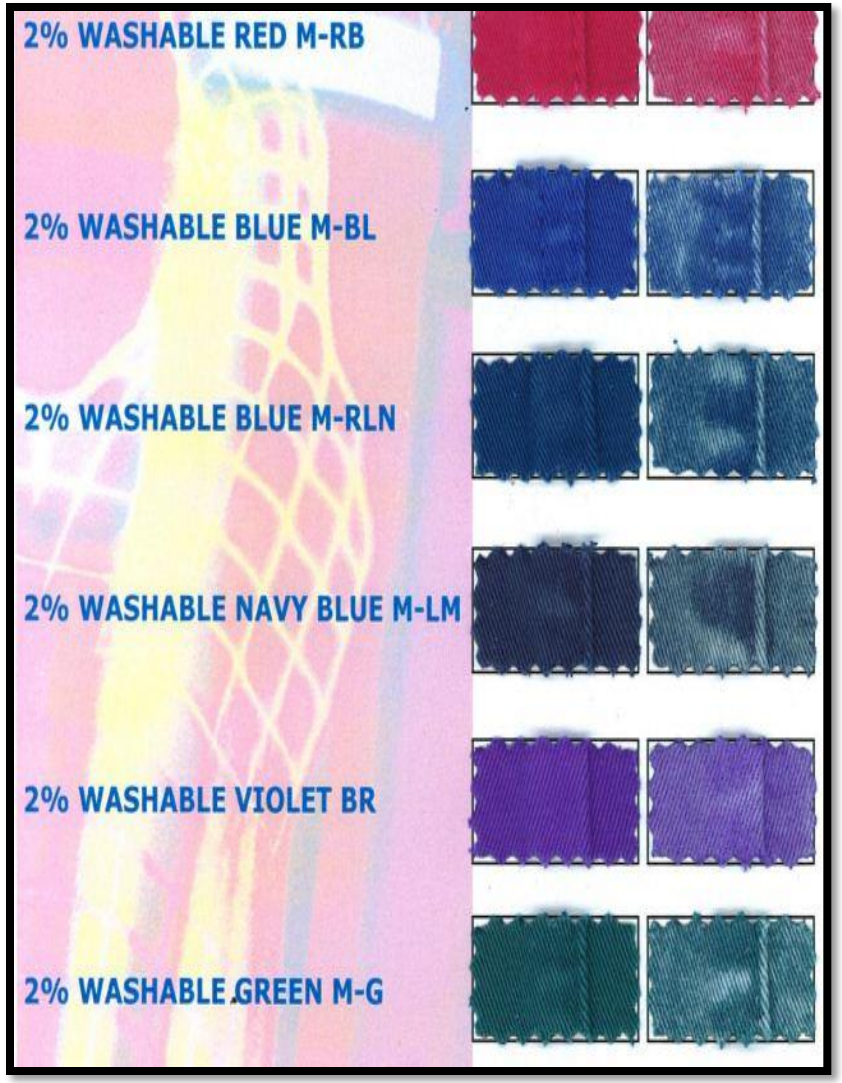
Reactive Dyes

- Dischargeable

Sulphur Dyes –e.g. sulfotex

Pigments

- Indigo
- Sulphur black



Dyes used in Garments Dyeing

Reactive vs Direct Dye

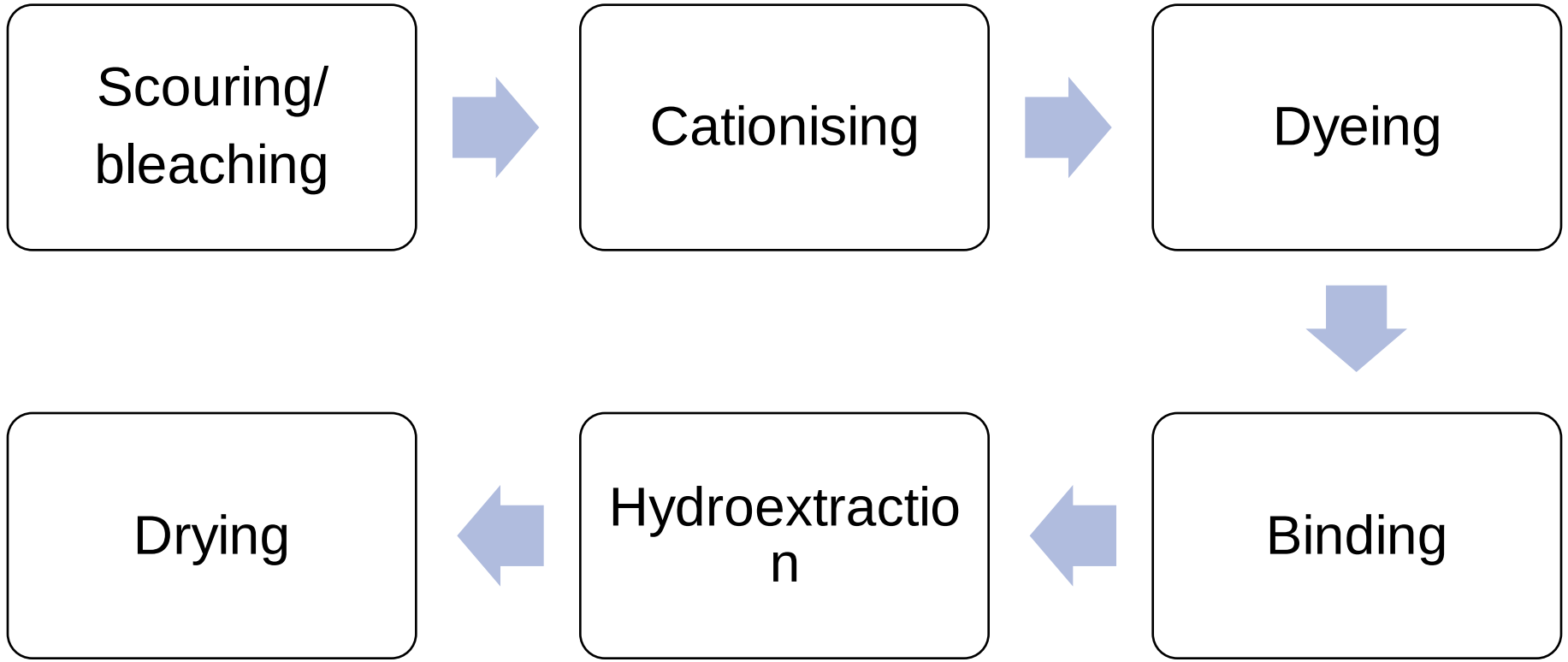
Dyes used in Garments Dyeing

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_2 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

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn

Friedrich-Ebert-Allee 32 + 36
53113 Bonn, Germany
T +49 228 44 60 - 0
F +49 228 44 60 - 17 66

Dag-Hammarskjöld-Weg 1 - 5
65760 Eschborn, Germany
T +49 61 96 79 - 0
F +49 61 96 79 - 11 15

E info@giz.de
I www.giz.de

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH