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 1**

Yarn dyeing

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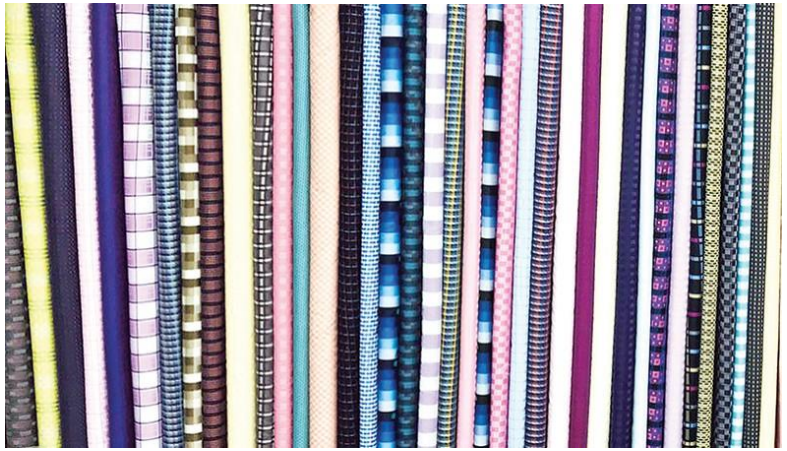
Dyeing of yarns before they have woven or the knitted into fabrics

Type of yarn dyeing

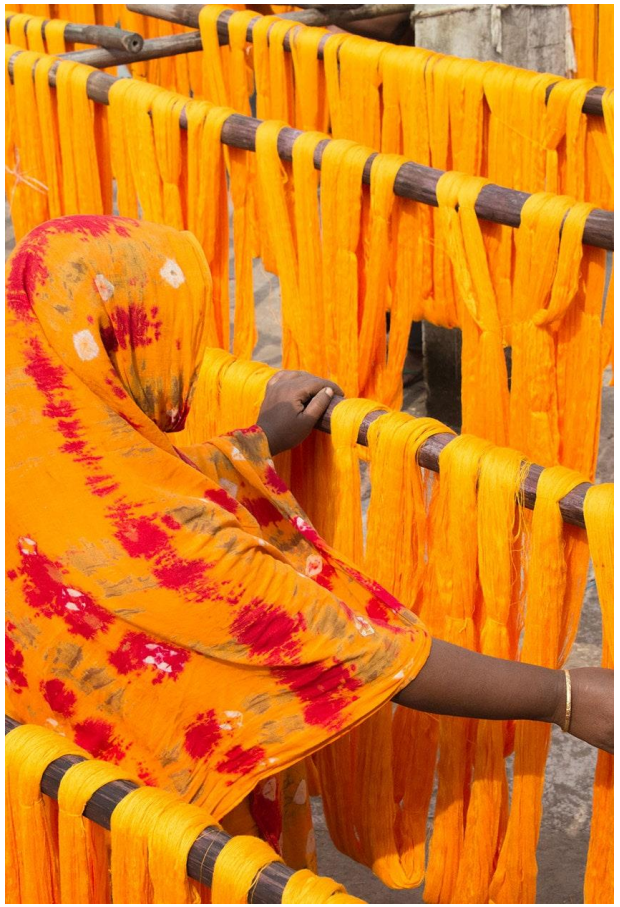
- Skein Dyeing – Hank dyeing
- Package Dyeing – Cone dyeing
- Beam Dyeing – a larger version of package dyeing
- Other Dyeing – Tape/elastic/lace



Basic concept of yarn dyeing

Hank dyeing

Skein Dyeing – Hank dyeing



Package Dyeing – Cone dyeing

Basic concept of yarn dyeing

Package Dyeing – Cone dyeing

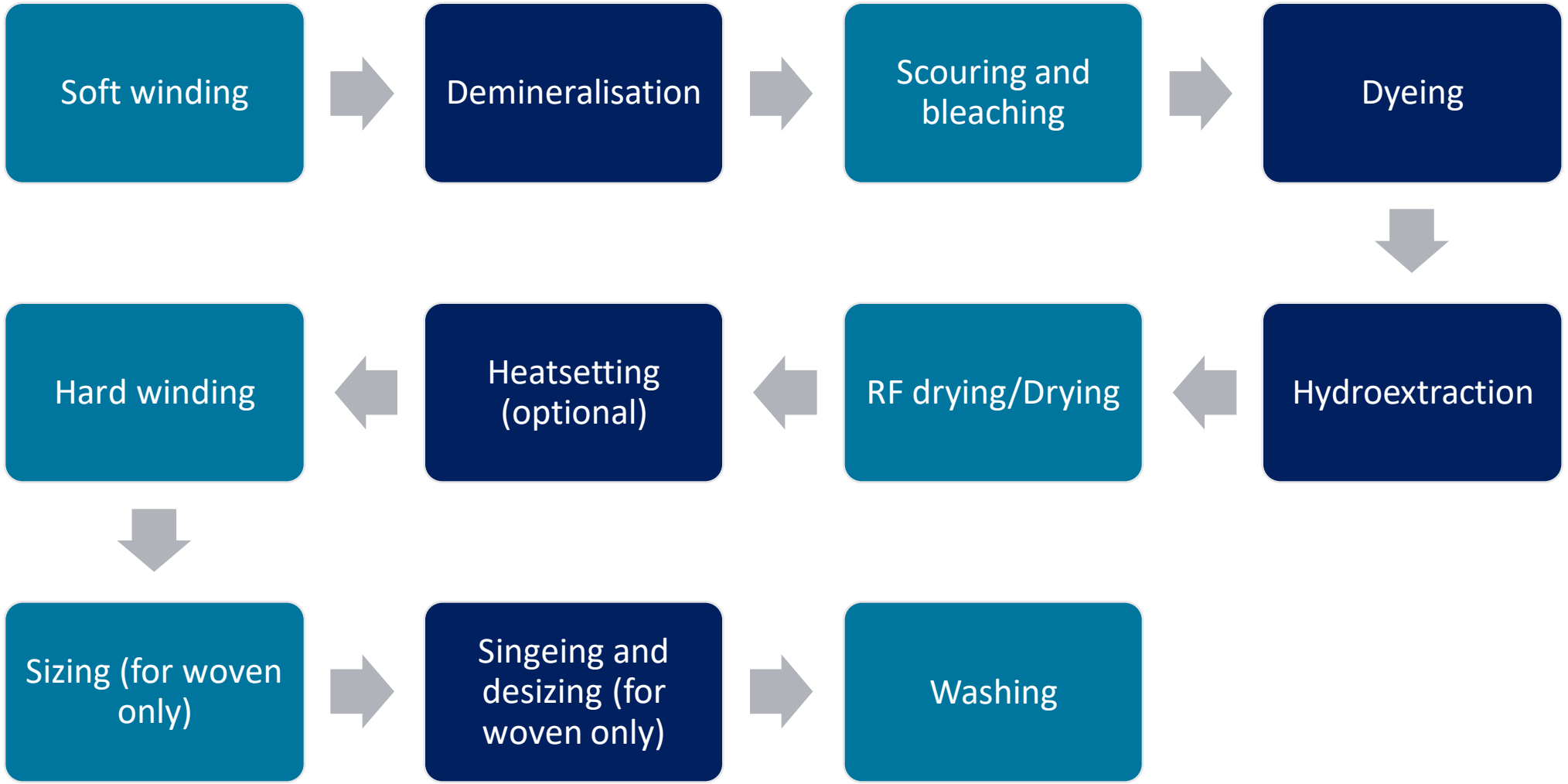


Basic concept of yarn dyeing

Beam Dyeing

Basic concept of yarn dyeing

Process flow of yarn dyeing



Example – Actual Yarn dyeing

Pretreatment

Yarn is wetted fairly with 90% water

↓

Chemicals are injected for 2 cycles 10-12 min at 40-50^{0}C

↓

Chemical dosing at 50ºC With Hold time 2 min & then Run for 4 min

↓

NaOH is injected for 5-6 min at 50^{0}C& the Run for 6 min.

↓

Temperature is raised to 60^{0}C & then H2O2 (50% Soln) is injected at 60^{0}C for 6 minute

↓

Run time 100^{0}C×48 min.

↓

Cooling at 75^{0}C

Dyeing

↓

Water filling & overflow is done for 10 minute

↓

Acetic Acid is added at temperature (36-40^{0}C)

↓

Run for 11 min

↓

Water filling & overflow is done for 10 minute

↓

Drain

↓

90% water filling

↓

Chemicals are injected & run for 6 min 40^{0}C

↓

Color is mixed at 40^{0}C with rest of the chemicals & then dosing for 30 minute

Washing/Finishing

Overflow for 12 min

↓

Acetic Acid is added at 40^{0}C for 1 cycle

↓

Overflow is done for 6-7 minute.

↓

soaping at 98^{0}C, 30 min to remove unfix color

↓

Sample Check

↓

If OK than drain

↓

Over flow for 10 min

↓

Hot wash is done at 60^{0}C & Run for 11 min

↓

Drain for 5 min

Source: http://diantextile.blogspot.com/2017/05/process-flow-chart-of-isothermal-yarn.html

Package Yarn dyeing

Yarn dyeing machine

Package Dyeing Machine

- A package dyeing machine is typically a cylindrical vessel, about 2 m high and 2 m wide, with a rounded bottom and lid.
- The yarn is wound into cheeses or cones using perforated former tubes.
- The packages of yarn are inserted onto vertical, perforated spindles in the machine.
- Each spindle typically takes 8–10 packages but the vertical columns of packages do not touch.

Yarn dyeing machine

Package Dyeing Machine

- The spacing of the spindles and hence the maximum load depends on the frame diameter and package size.
- The dye liquor is pumped into the base of the frame and up through the perforated spindles.
- The dye liquor flows up the perforated spindle and flows outward through the packages of wound yarn.
- It then flows back down over the outside of the frame and back to the pump. Heating is usually with super-heated steam in coils situated just below the frame carrying the spindles.

Yarn dyeing machine

Package preparation

Package preparation is a crucial step. Some of the factors influencing the stability of a package and its permeability to dye solution are:

- the denier or tex of the yarns or filaments;
- the degree of twist of the yarn;
- the extent to which the yarn traverses the package (cross-winding) and its tension;
- the degree of swelling or shrinkage that occurs in hot water;
- the actual shape of the package.

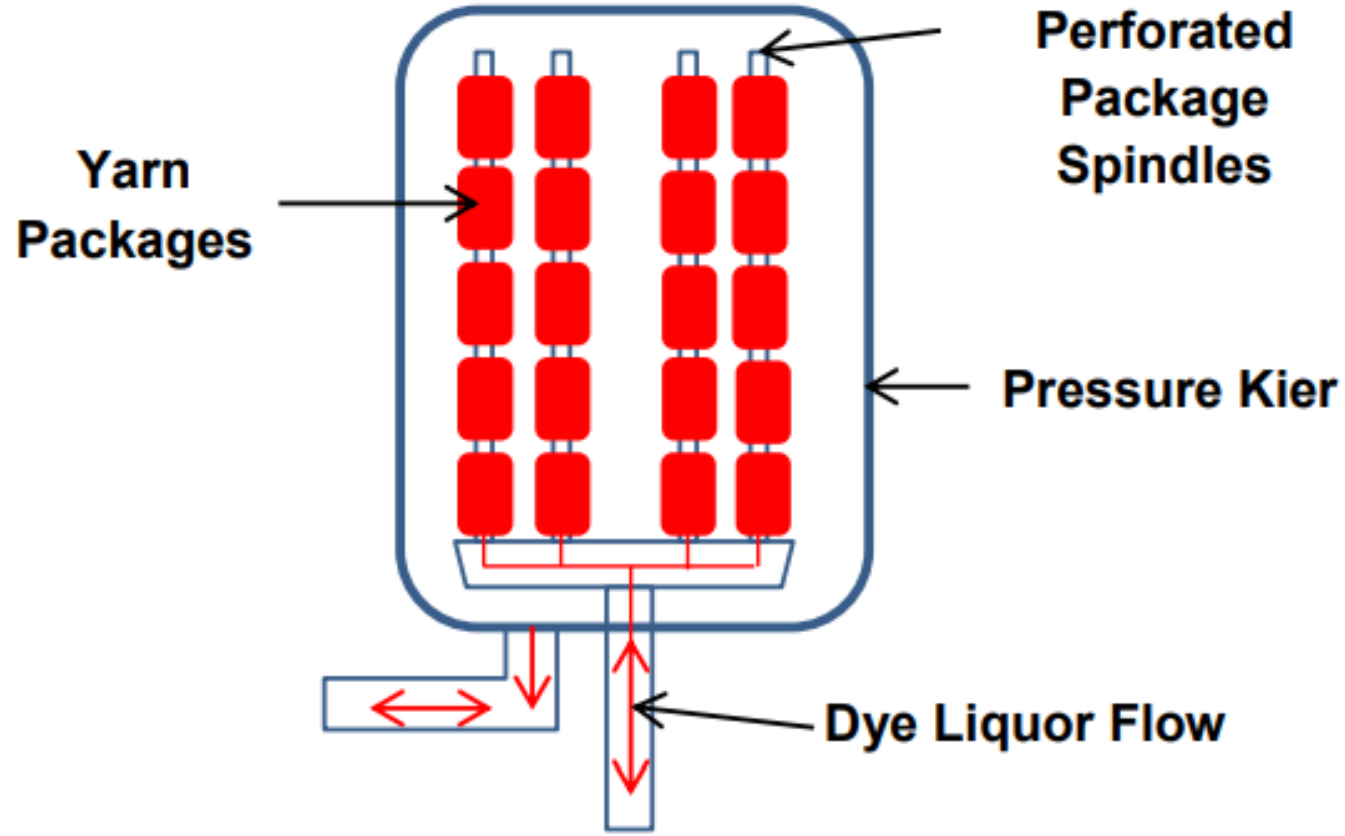
Yarn Dyeing machine - Package dyeing

Package dyeing

Yarn dyeing machine - Package dyeing

Yarn dyeing machine - Package dyeing

Yarn dyeing machine - - Package dyeing

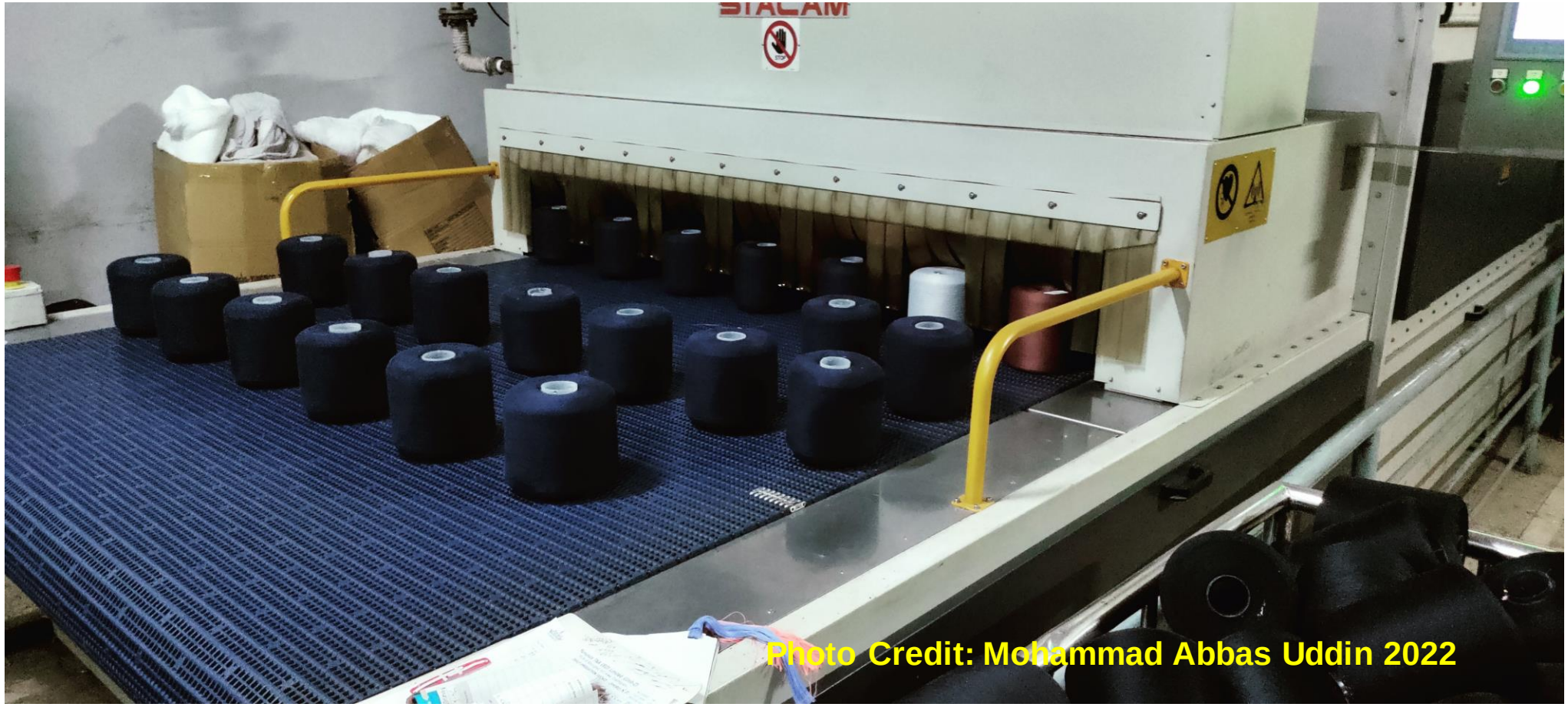


Yarn dyeing machine - Package dyeing

Yarn hydroextractor

Yarn dyeing machine - Package dyeing

RF Drying - In



Yarn dyeing machine – Package dyeing

RF Drying - Out

Yarn dyeing machine – Package dyeing

Dyed and Finished package

Yarn dyeing machine – Package dyeing

Hard winding

Basic concept of yarn dyeing

Raw yarn

Winding for dyeing

After dyeing

Re-winding for finishing

Yarn dyeing machine – Package dyeing

Yarn dyeing problem

Hank dyeing

Yarn dyeing machine – Hank Dyeing

Hank process before dyeing

Yarn dyeing machine – Hank Dyeing

Hank process before dyeing

Yarn dyeing machine – Hank Dyeing

Hank Dyeing machine

Yarn dyeing machine – Hank Dyeing

Hank Hydroextractor

Yarn dyeing machine – Hank Dyeing

Hank Drying

Yarn dyeing machine – Hank Dyeing

Hank to Cone process

Photo Credit: Mohammad Abbas Uddin 2022

Tape/Elastic/Lace dyeinging

Yarn dyeing machine – Tape/Elastic/Lace Dyeing

From Padding to Finishing – One machine
Padding – Steaming/Drying – Washing – Finishing- Calendaring

Yarn dyeing machine – Tape/Elastic/Lace Dyeing

Padding

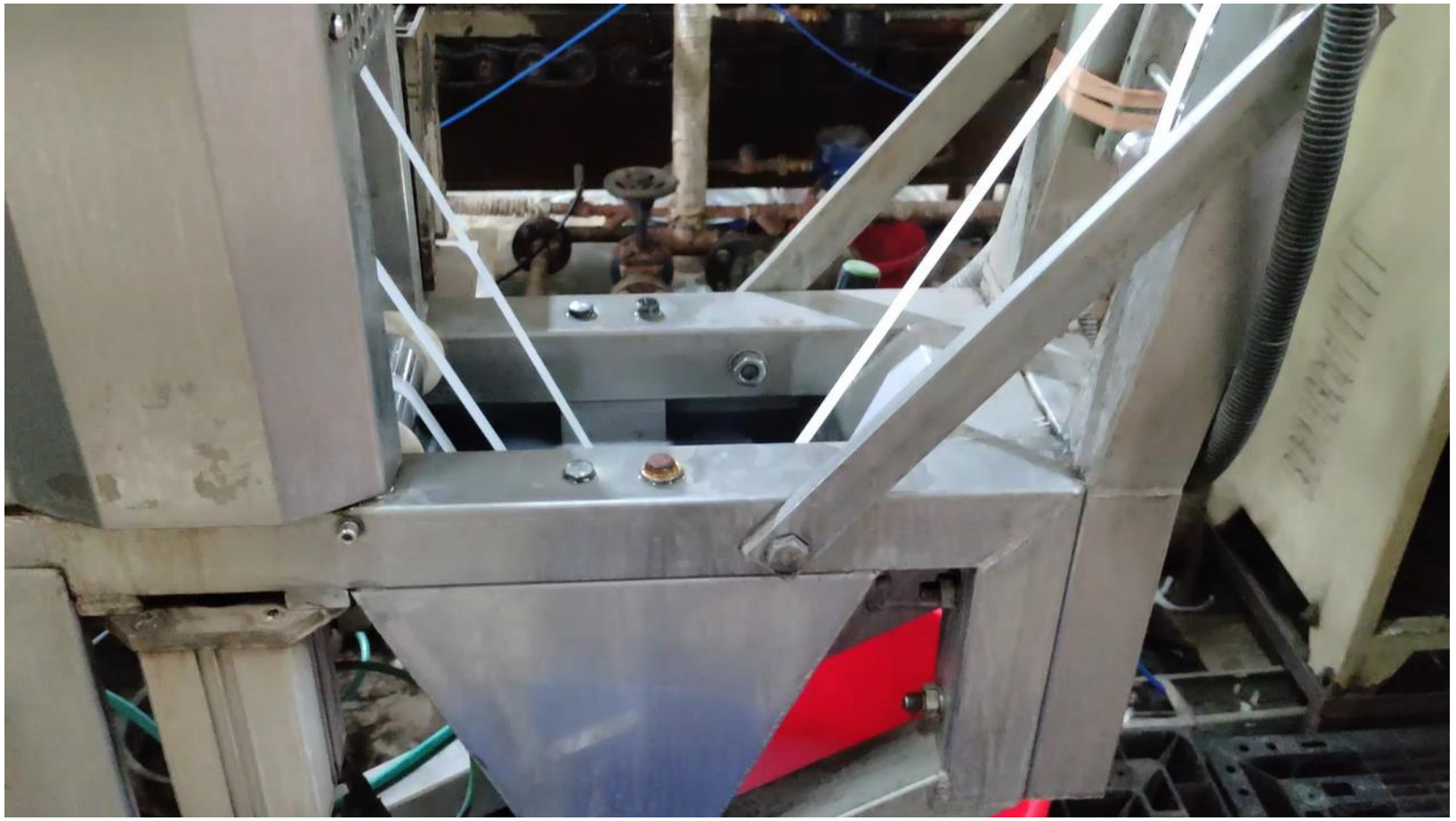


Photo Credit: Mohammad Abbas Uddin 2022

Yarn dyeing machine – Tape/Elastic/Lace Dyeing

Padding-steaming-washing-finishing

Photo Credit: Mohammad Abbas Uddin 2022

Yarn dyeing machine – Tape/Elastic/Lace Dyeing

Steaming and washing chamber

Yarn dyeing machine – Tape/Elastic/Lace Dyeing

8 Washing Chamber

Photo Credit: Mohammad Abbas Uddin 2022

Yarn dyeing machine – Tape/Elastic/Lace Dyeing

8 Washing Chamber

Yarn dyeing machine – Tape/Elastic/Lace Dyeing

8 Washing Chamber – But not all are used

Photo Credit: Mohammad Abbas Uddin 2022

Process optimization

Yarn dyeing – Process optimisation

About 2 hours	About 2 hours	?? Hours, for good fastness
Pretreatment	**Dyeing**	**Washing-Soaping-Rinsing**
“ Chemical” time. due to Substrate Chemical system Almost fixed About 20% of total water and energy	“ Chemical” time. Due to dyestuffs. Almost Fixed About 10% of total water and energy	“ Physical” time. Also due to machine efficiency. Widely Variable About 70% of total water and energy

Yarn dyeing – Process optimisation

- Dyeing machine efficiency
  - ✓ Optimized flow-rate
  - ✓ Intensive exchange dyeing-rinsing liquor / material
- Washing performance
  - ✓ Optimised rinsing
  - ✓ High-efficiency wash-out and soaping

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