

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 4: Presentation 3

Process Optimisation – Printing

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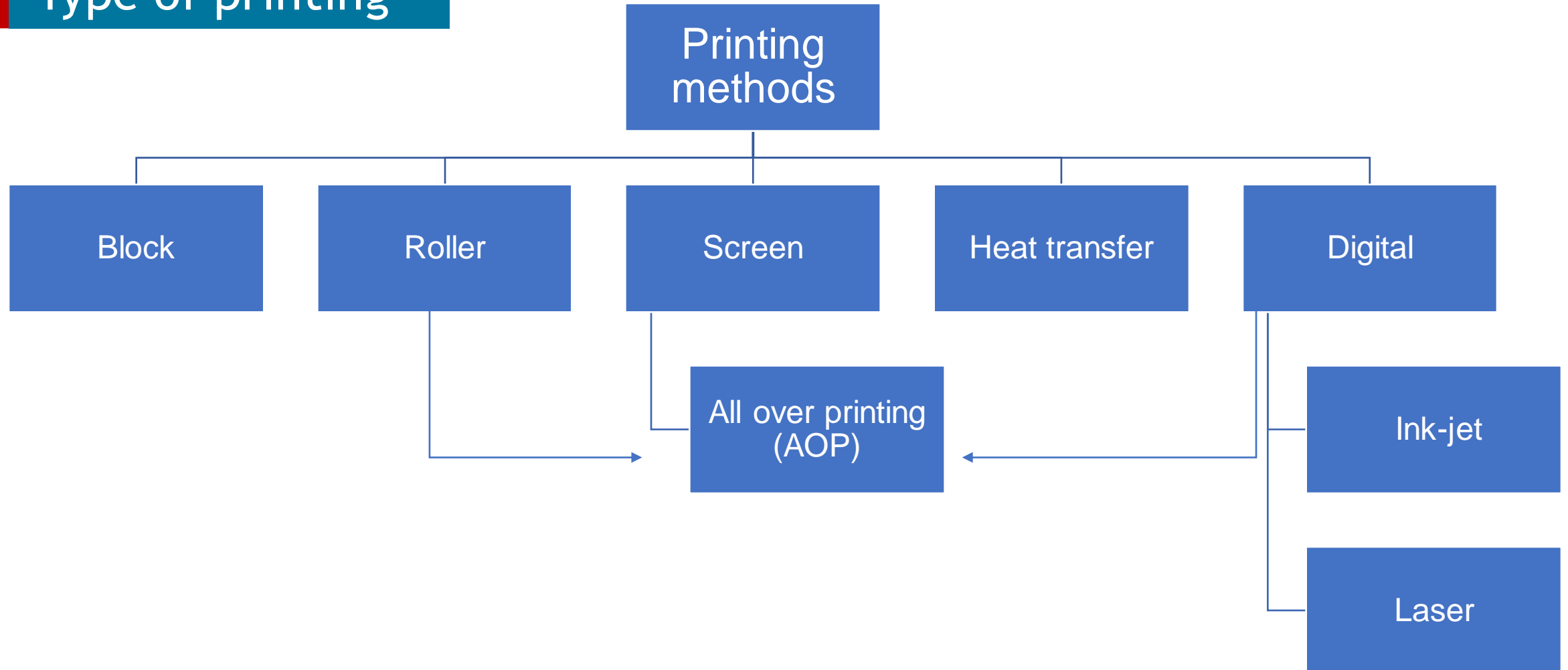
Printing Basics

What is printing?

Textile printing is the process of applying color to the fabric in definite patterns or designs



Type of printing



Block Printing



Roller printing



Screen Printing



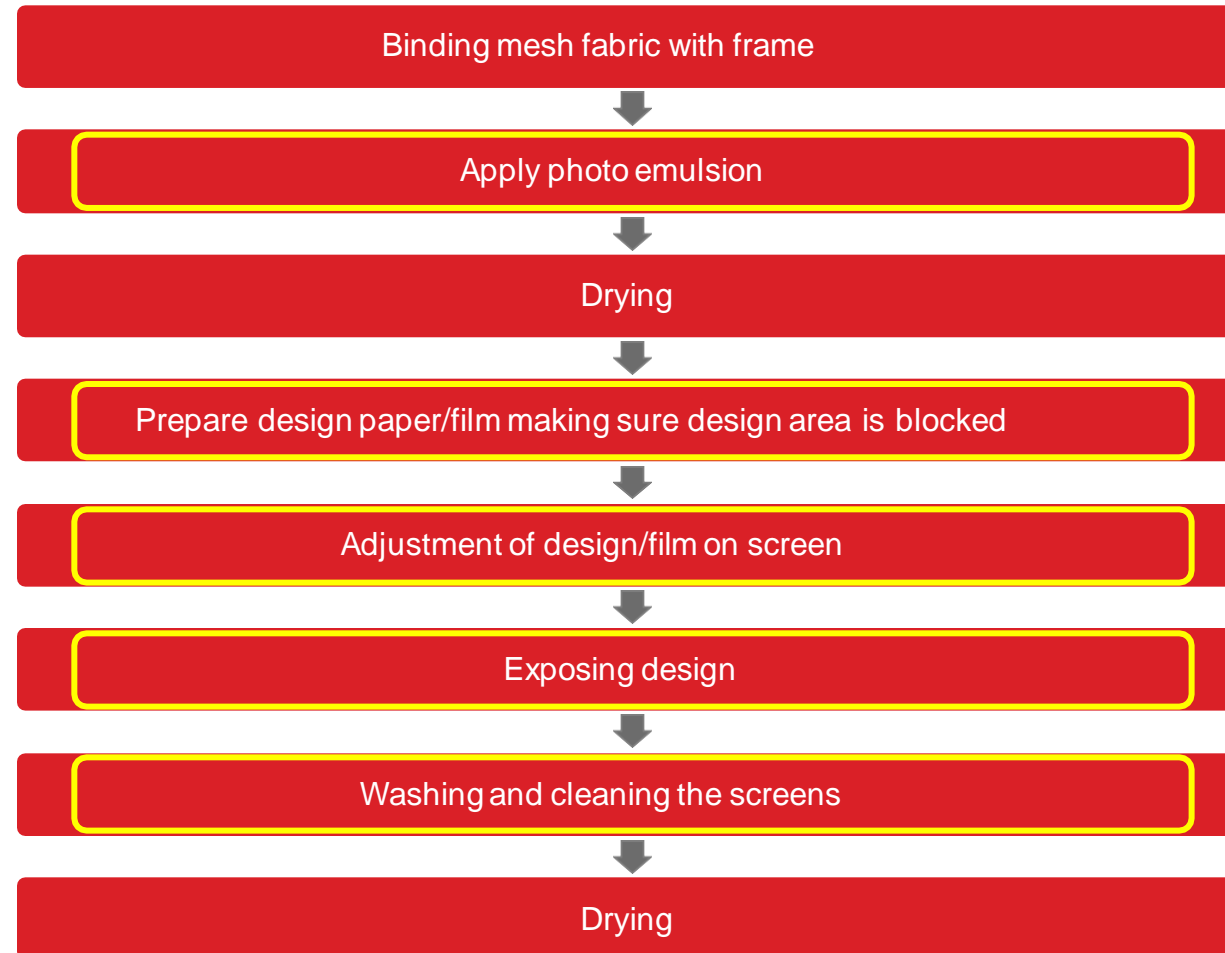
Transfer Printing



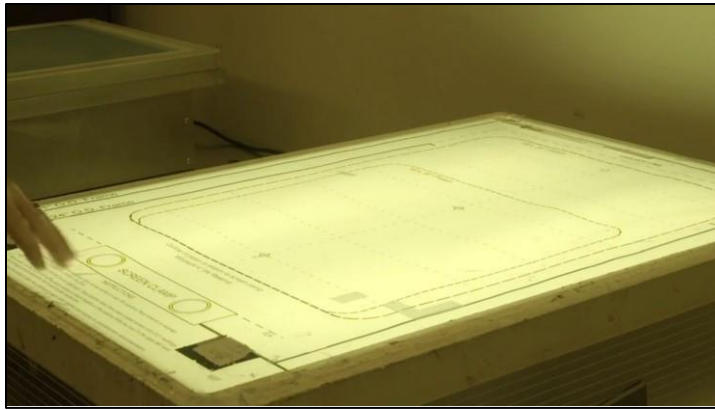
Screen Printing

Screen Printing

The traditional film to screen method of exposing the design to the screen uses blacked out design area on film to keep away the light from the chemicals. This prevents the chemicals of the design areas from hardening and after cleaning the design is exposed on the screen.



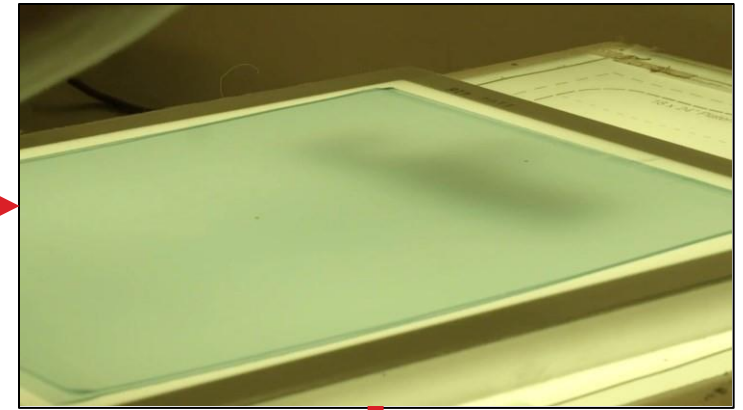
Traditional Screen Preparation Process



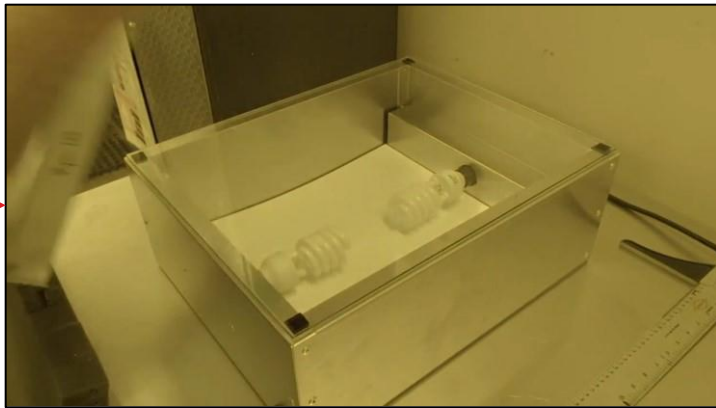
Film placement



Screen placement and marking



Tape film to screen



Expose in
lightbox

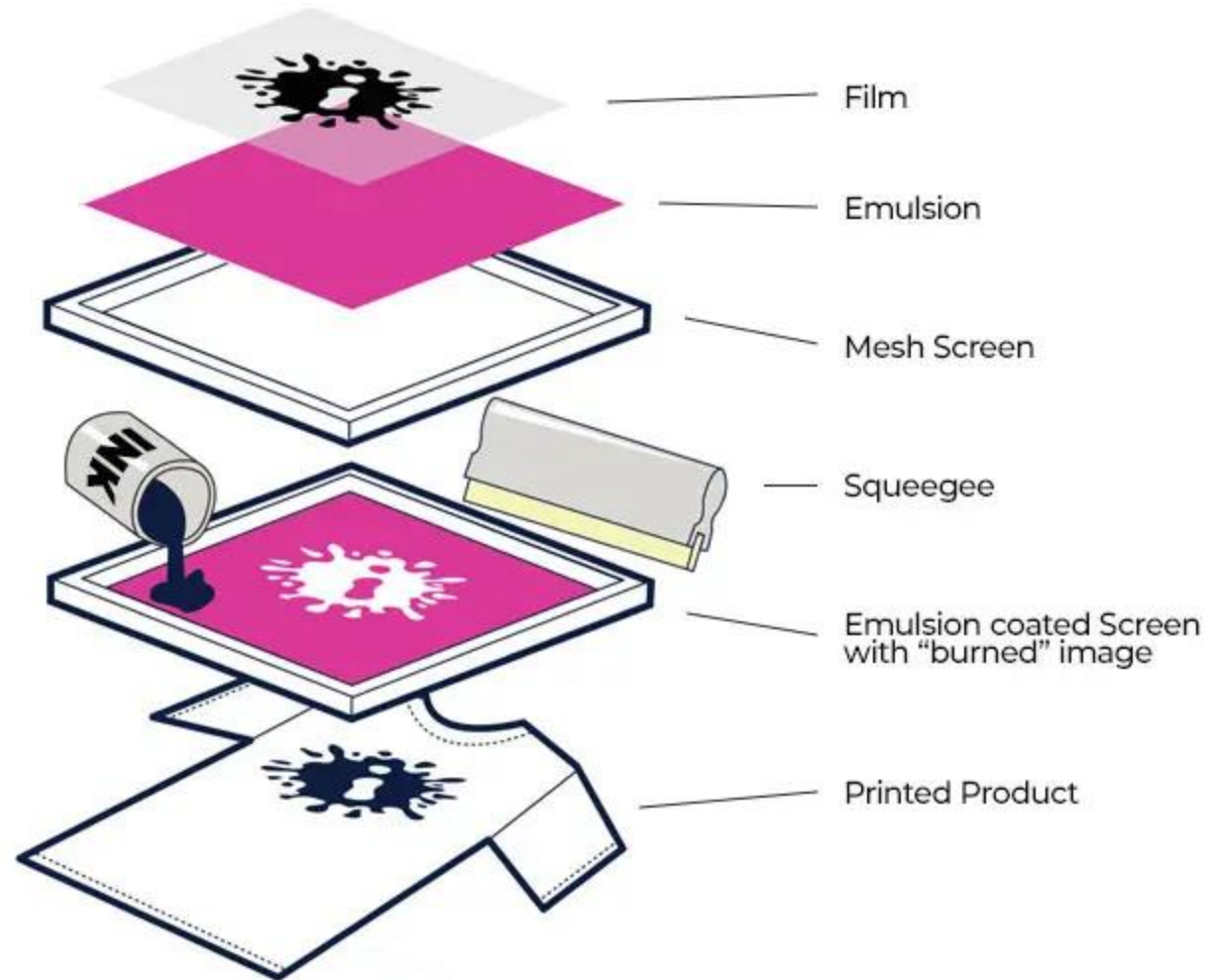


Wash with
water spray

Source: Printing, CHT Group

Screen printing process steps

THE SCREEN PRINTING PROCESS



Screen printing process steps



Source:
Guangdong Yincai Science & Techn

Screen printing process steps



Screen printing process steps



Water use

Printing paste preparation STEP 4

Ingredients	Amount
Binder	100 parts
Water	895 Parts
Emulsifying agents	2 parts
Synthetic thickener	2-3 parts
Softener	10-20 parts (optional)
Urea	10-20 parts (Optional)
Total	1000 parts



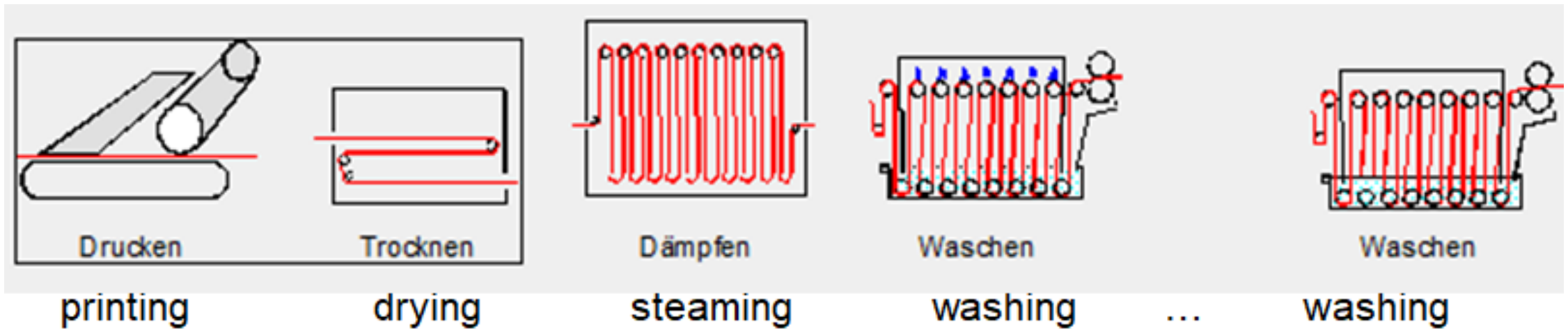
Screen printing process steps

STEP 5 Printing paste application



Screen printing process steps

STEP 6



Screen printing process steps



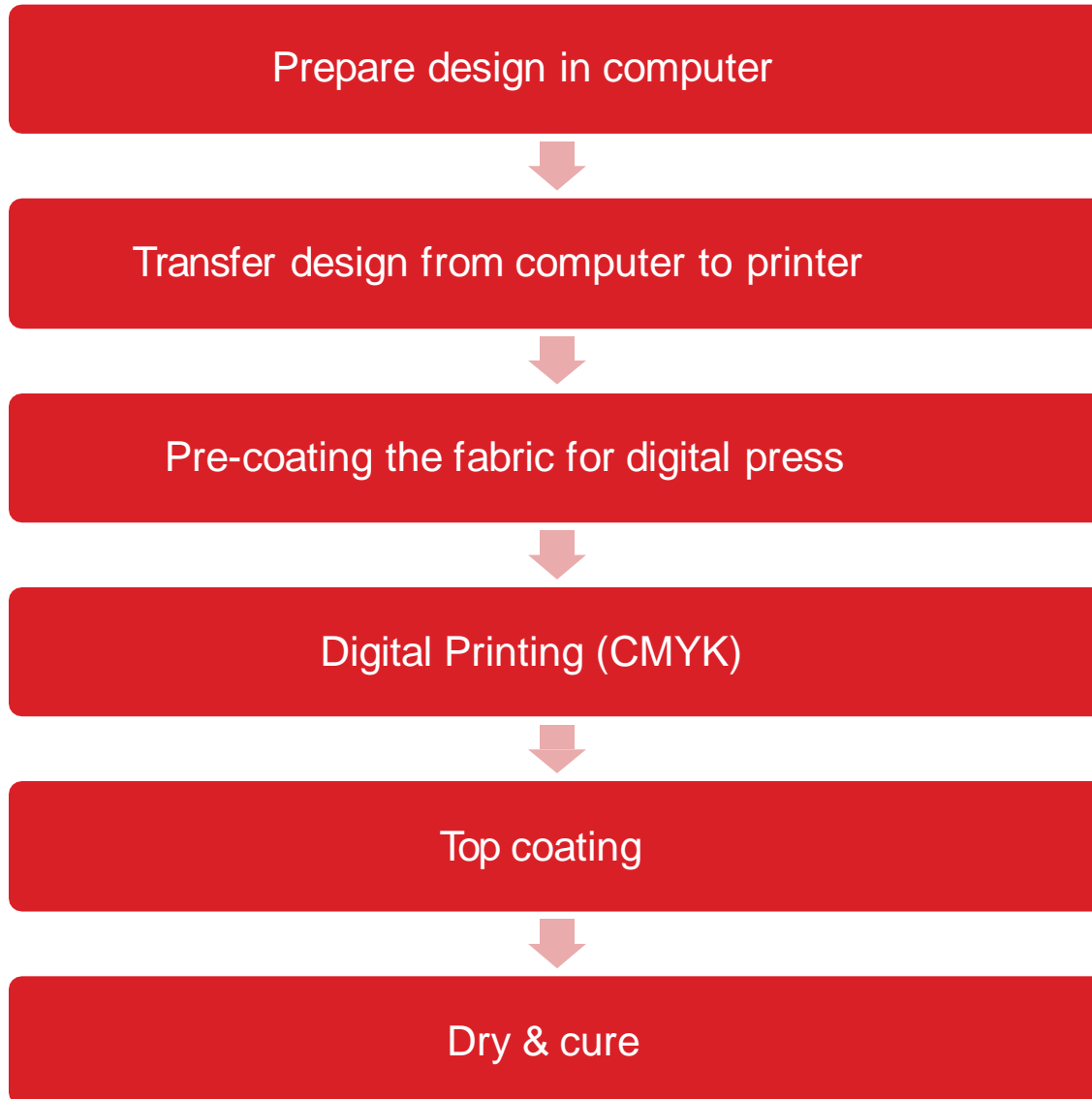
Source: Guangdong
Yincai Science &
Technologies

Digital Printing

Limitations of traditional screen printing

- More limited color ranges available while executing complex photoprints
- Complicated color separation for the artwork
- Shade variation in photo prints
- Amount of ink/paste used in different layers make the design a raised from the print material
- Need too many screens as well as higher wastage of pigments & chemicals
- More work hours needed both in screen & design preparation and printing process

Digital Printing



Digital printing is a much newer process that involves your artwork being processed by a computer, and then printed directly onto the surface of your product. Digital printing is not a heat transfer or applique, as the ink is directly adhered to the fabric of your shirt. Each printing process has its strengths, and our artwork team will weigh these when deciding which to use for your design.

Printing: Digital Inkjet



Digital Printing



Digital Printing

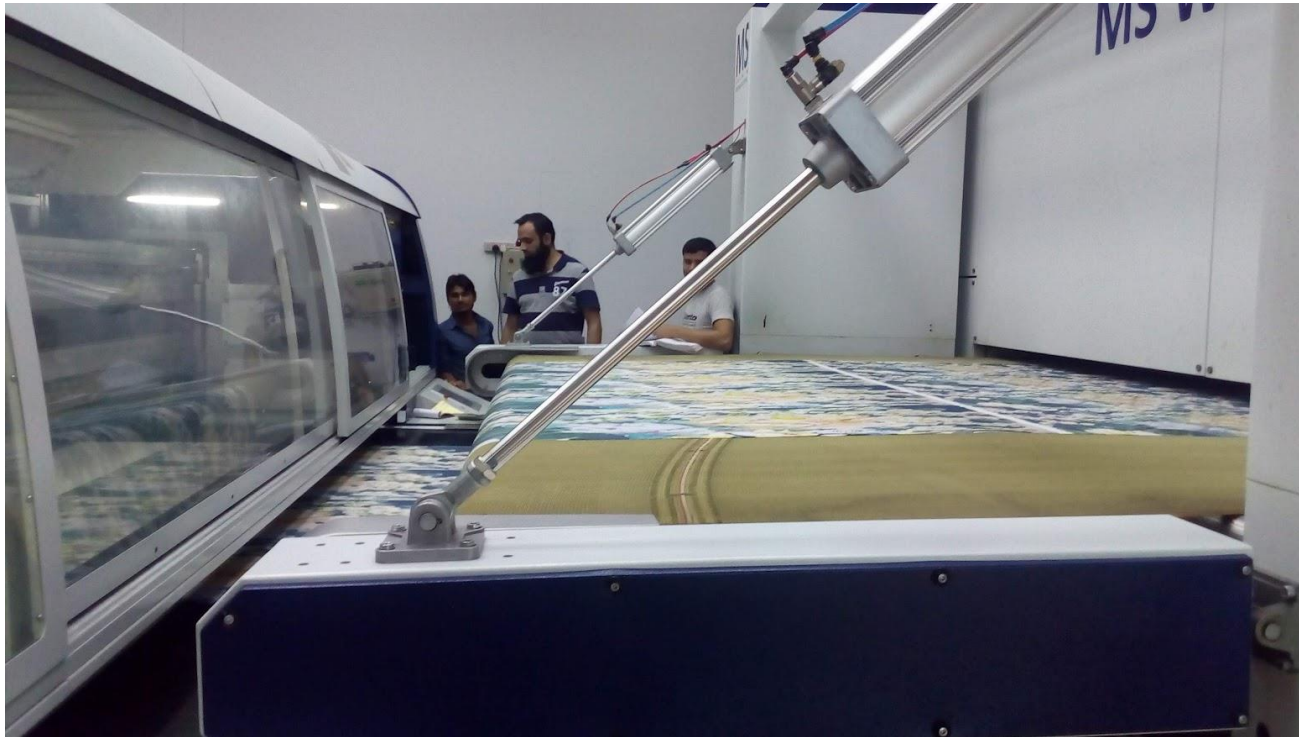


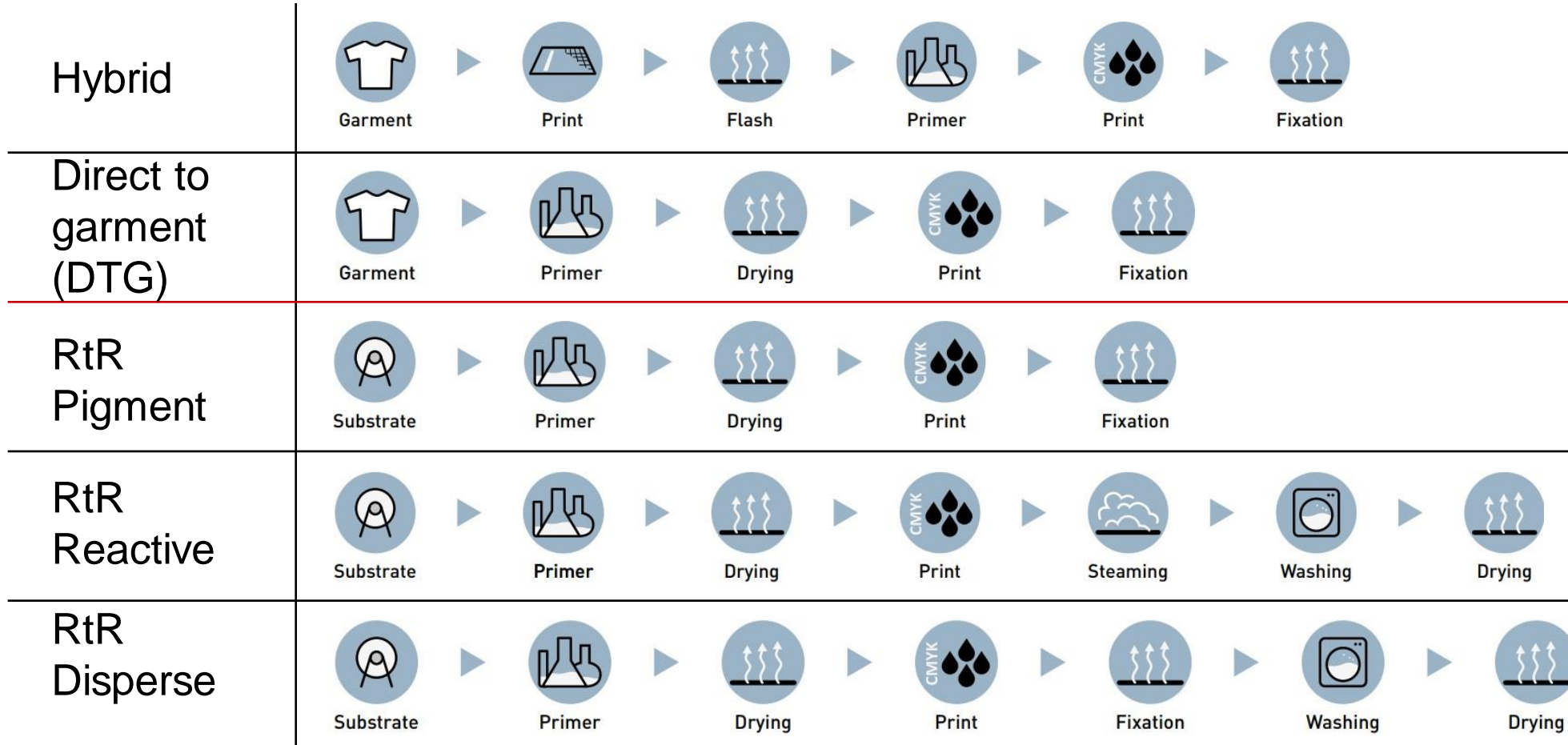
Photo credit: Mohammad Abbas Uddin

Digital Printing



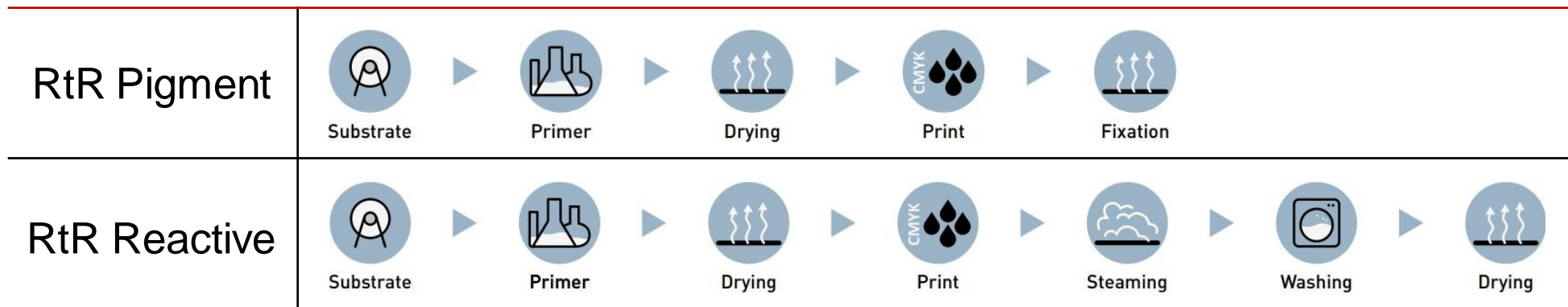
Digital Printing

Digital Printing Processes



Digital Printing

Digital Printing Processes



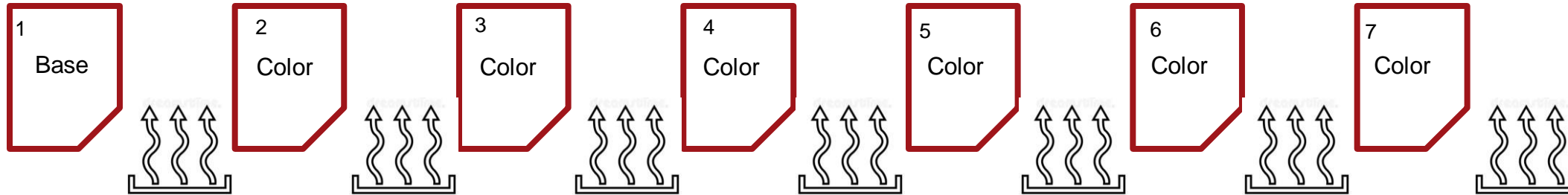
Source: Printing, CHT Group



Executing complex designs and multicolor prints like this is possible in screen printing but requires a lot of screens and a lot of time to setup, otherwise there may be quality problems as well as alignment problems

Digital printing handles complex designs with multiple colors with ease reducing the amount of screens needed for the print as well as saving time for setup

Screen Printing



Digital Printing



A 6 color print process in screen and digital printing: DTG Reduces

1. Number of screen from 7 to 3
2. Number of curing units from 7 to only 3

More benefits of digital printing

40-45%

cost saving in screen preparation



Source: Printing, CHT Group



35-40%

Flash Energy saving



Up to 20%

Energy saving in machine operation

Source: Printing, CHT Group

Overall

30-35%

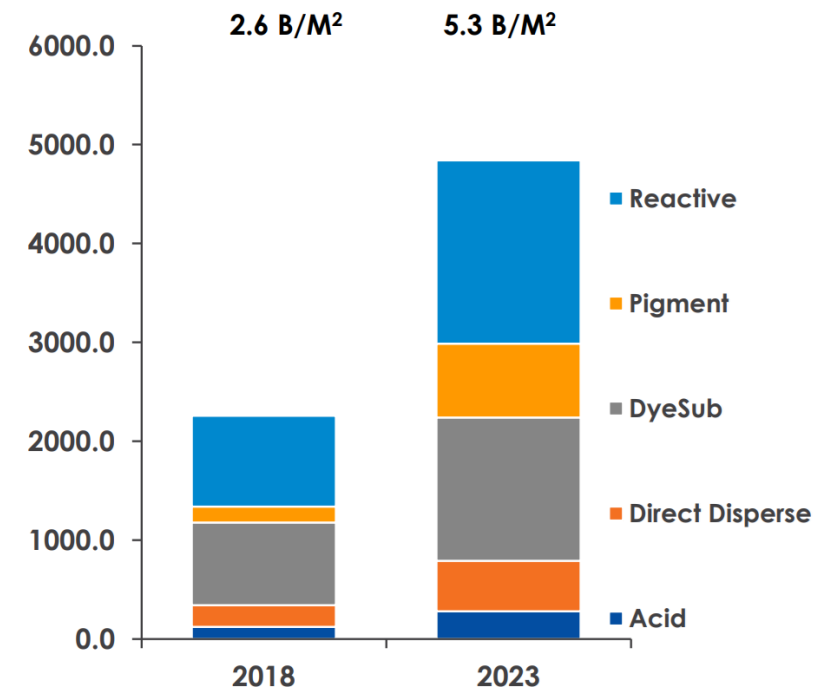
Saving in operational cost

DIGITAL REACTIVE VS DIGITAL PIGMENT

- Despite consuming less energy and water, pigment in digital printing is not (yet) the dominant technology
- Dye-Sub for polyester and reactive for cotton are the dominant and will stay the main inks in the future.
- Pigment though will have the highest growth rates

Source: InfoTrends 2016-2021 Digital Textile Printing Industry Forecast, © Keypoint Intelligence

Forecast:
Digitally printed textile by ink type



RtR Digital Printing Processes

https://www.youtube.com/watch?v=_YQbJD7-DmM

Description

- ▶ Print from roll-to-roll in the fastest process possible
- ▶ Complex wet processes are no longer necessary, which in addition saves water and energy.
- ▶ After fixing, goods can proceed directly to the next processing step or be sent for retail.
- ▶ Perfect for start-ups in digital textile printing without textile expertise..



Features

- ▶ Quick process: prime, print, fix.
- ▶ No water consumption due to steaming or washing
- ▶ Universally applicable for (almost) all fibre types
- ▶ Maximum fastnesses to light

Process & Recipe

An Example for 200 GSM Cotton Knits:

Padding

TUBIJET NWA	5 g/l
TUBIJET COLOR P16	20 g/l
TUBIJET FAST P11	20 g/l
TUBIJET BALANCE P15	30 g/l
Stenter Drying at 110 °C	2 min

Digital Pigment Printing

Stenter Drying & Fixation at 150 °C 5 min

Optional Post-treatment

TUBIJET FAST P11	30 g/l
TUBIJET FAST P12	30 g/l
Stenter Drying & Fixation at 150 °C	3 min

Source: Printing, CHT Group

PROCESS: RTR REACTIVE

Description

- ▶ Perfect addition for your conventional reactive printing.
- ▶ Simplifies your print process especially for sophisticated, multi-coloured motifs.

Process



Features

- ▶ Soft handle
- ▶ High color brilliance
- ▶ Very good wash fastness
- ▶ Low ink costs

Source: Printing, CHT Group

Process & Recipe

An Example for 200 GSM Cotton Knits:

Padding

Rapidoprint SC 10	2 g/l
Rapidoprint XR Granulate	10 g/l
TUBIJET DU 02	50 g/l
TUBIJET SHARP R 104	50 g/l
Sodium Carbonate	5 g/l
Sodium Bicarbonate	40 g/l
Urea	100 g/l
Stenter Drying at 110°C	2 min

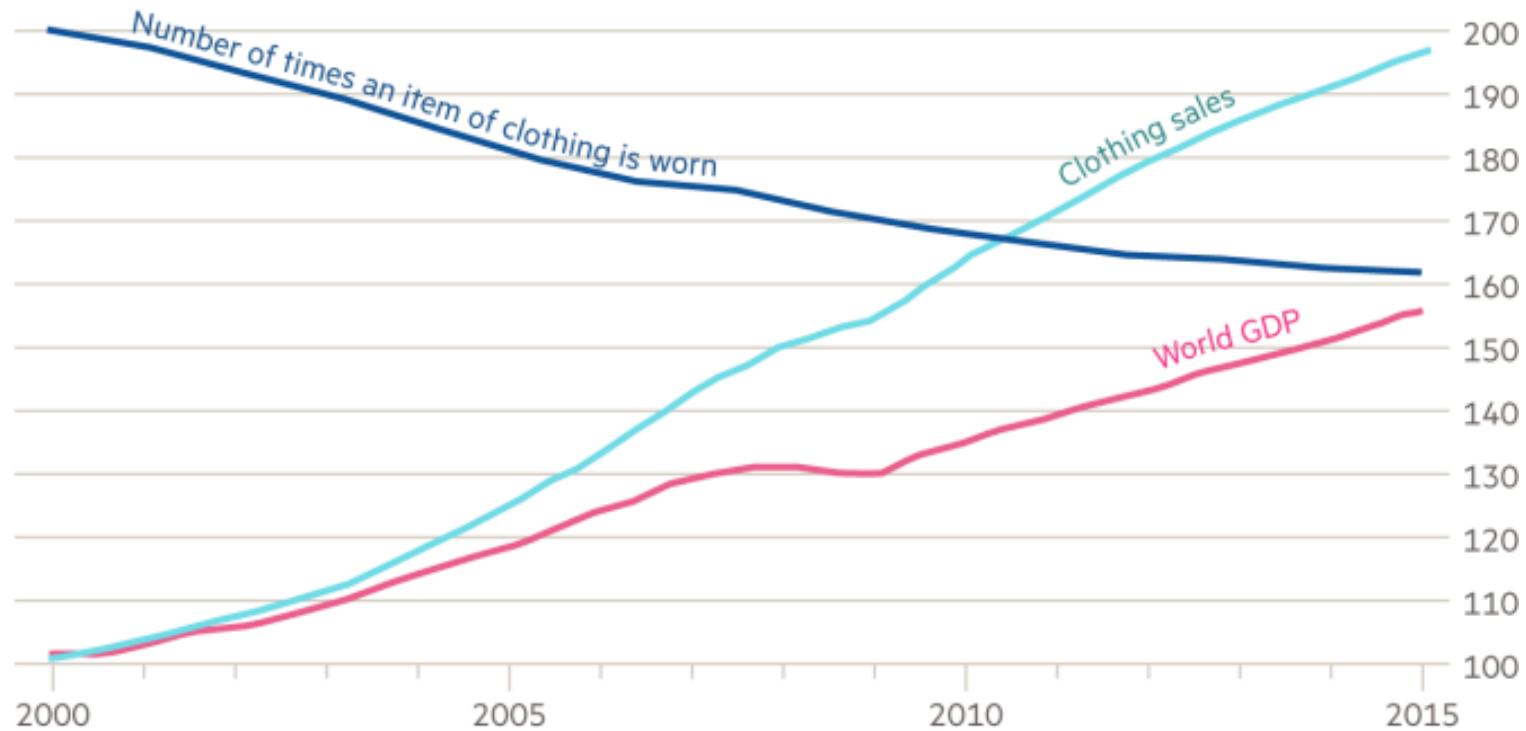
Digital Reactive Printing

Steaming 102°C	12 min
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Washing

ONE GAP THAT WE NEED TO CLOSE

- ▶ Digital printing due to its fast-time to market might accelerate the following trend:



Water minimization in Printing

Water minimization in printing

Environmental Impact of Traditional Methods

Exposure Films

A 1-year study in Australia based on 100 screens per day demonstrated the elimination of

**12,000 Meters Of
Film Annually**

that would typically be destined for a landfill

*Study calculations are based on 240 working days per year

Water Usage in Screen Cleaning

The same 1-year study referenced above with an average production of **100 screens per day** concluded that

120,000 litres of water

was consumed using a traditional image washout process.

Source: Printing, CHT Group

Water minimization in printing

- Wash off
 - using water jet to clean the new screen
 - using less water for cleaning used containers
 - using low grade or recycled water from ETP for used screen cleaning
- Process modification
 - Modifying or Eliminating various steps
 - Changing printing types with modern machines

Water minimization in printing

Installation of Automatic Water Shut Off Valves at Rotary and Flatbed Printing Machines' Blanket Washing Water

- The printer table blanket is washed with forced water jets by means of two or three rows of multiple nozzles to remove the stains adhered to the blanket during printing operation
- Generally, the blanket washing water at the printing machines is kept on running and wasted during machine stoppage (due to maintenance or change over)
- This water wastage can be avoided by installing automatic water shut off valve at the printing machines
- The water saving is in the range of 50 to 90 m³/d

Economics

Capital cost = Rs. 100,000 to 200,000

Annual saving = Rs. 0.24 to 0.44 million

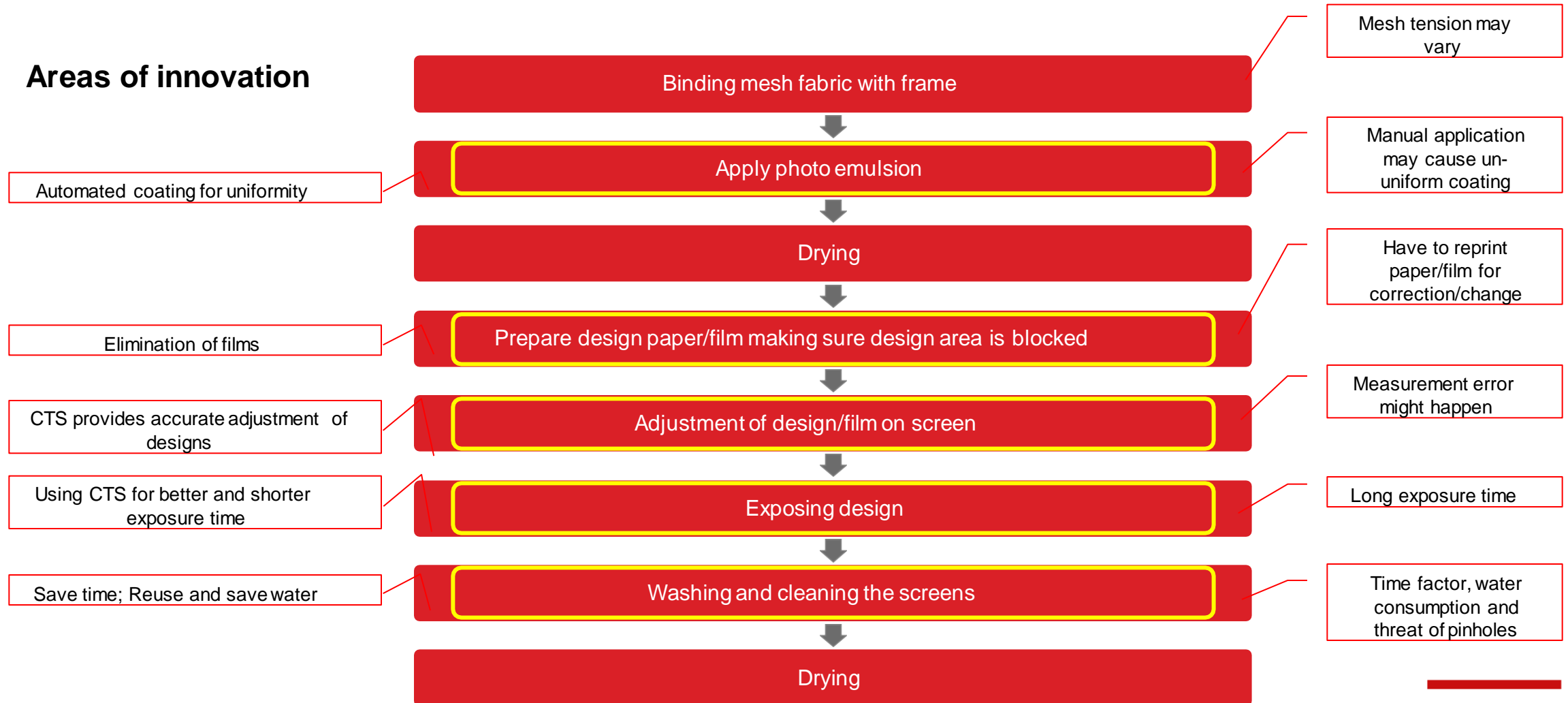
Annual O&M cost = Rs. 50,000 to 100,000

Simple payback period = 6 to 7 months



Water minimization in printing

Process modification



Water minimization in printing

Modern Technology

HEALTH · SAFETY · ENVIRONMENT

SPECIALIST printing worldwide

CLEANING UP THE TEXTILE INDUSTRY

Dr Simon Daplyn explains why digital printing is a positive step towards sustainability in textiles

Fresh water is fast becoming a finite resource and globally, conservation of water, alongside reducing the polluting impacts of large industry, are critical areas being discussed and addressed. In one key example, it is widely acknowledged that today, textile processing accounts for 20% of all fresh water pollution.

Not only is the textiles industry the biggest polluter, it is also one of the biggest consumers of water, using billions of litres per day within treatment, processing and decorating of fabrics. These issues are interlinked when considering that many of the major textile production areas of the world such as India, Bangladesh, Brazil, and China face an acute scarcity of water.

Whilst not the biggest contributor to this pollution and water usage, textile printing is a targeted area of concern. The textile printing industry is increasingly under fire from lobby groups and particularly the DETOX campaign of Greenpeace. The campaign target is to get leading garment manufacturers and brands to commit to the elimination of toxic and harmful chemicals from the supply chain by 2020. Many leading brands have already signed up to this or have their own programs with the same end goal. These programmes and guidelines restrict the use of certain materials both from an environmental and customer contact point of view. Examples of such guidelines and organisations include Detox, BlueSign, Indes Clear to Wear and ZDHC. Compliance to such requirements can be complex but more clarity is offered as some organisations start to recognise each other's standards and certified partners.



Summit's Alpha technology reduces water, chemical and energy consumption without compromising the quality and performance of the printed fabric.

DIGITAL DETOX
Many brands are implementing digital printing technologies, a more environmentally friendly process that doesn't compromise cost or performance. By switching from analogue printing processes to digital, data already shows a huge impact, not only in reducing water consumption and pollution, but also in decreasing energy use, CO₂ emissions, waste materials and time. Many complementary studies show an average reduction in water consumption of 60%, energy consumption of 55% and a 95% reduction in CO₂ emissions.

These clear environmental benefits are further enhanced by studies showing lead-time for printed goods reducing by 80%, water reduced by 85% and a reduction in the use of chemicals in excess of 90%.

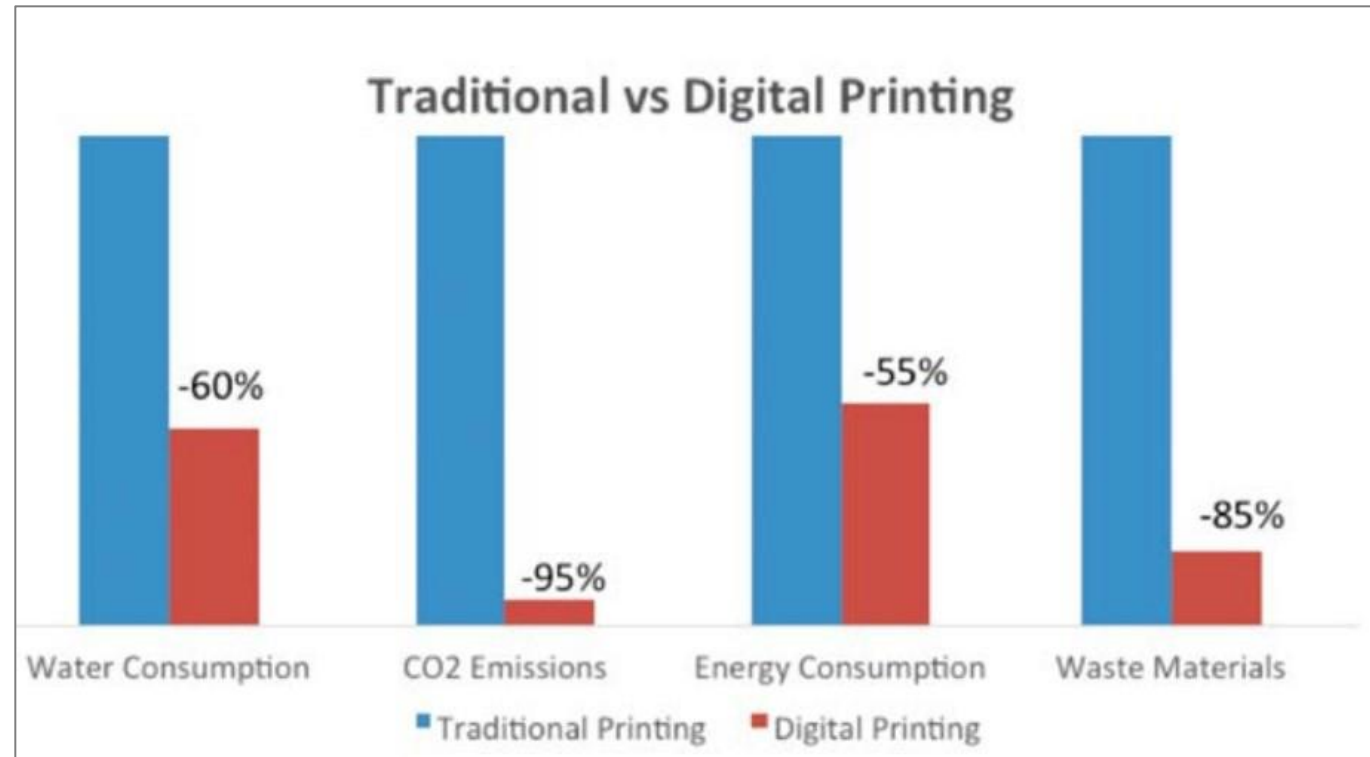
FURTHER IMPROVEMENT
Despite these significant benefits, it is clear that the textile printing industry can do more to drive a further improvement. Many printing technologies require the fabric to be pre-treated with chemicals, with the printed design then fixed to the fabric in a steaming process. The energy consumed and CO₂ produced by heating water by coal or oil furnace to create the required steam is significant. A subsequent washing cycle (often involving multiple stages) is applied to remove any chemicals and unfixed colour from the textile. It is highly required to treat the effluent water resulting from such processes before release back into the water system requiring energy, time and cost.

There are some strong initiatives in water recycling with the first zero-discharge factories emerging where 100% of water from each process is recycled and re-used. Today this is expensive, but as more factories adopt such schemes, the price is expected to come down considerably. Limiting the reliance on water supply and treatment opens up the possibility



Category	Traditional Printing	Digital Printing
Water Consumption	100%	40%
CO ₂ Emissions	100%	5%
Energy Consumption	100%	45%
Waste Materials	100%	15%

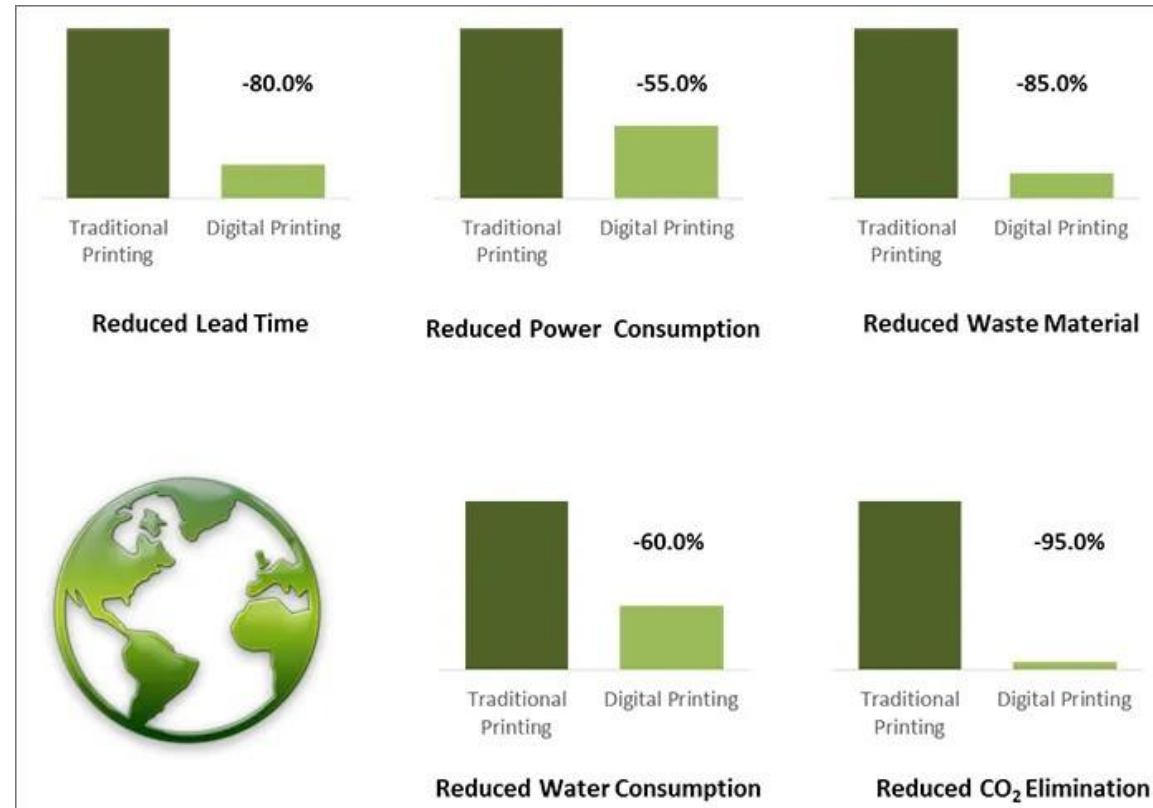
Impact of digital printing technology in reducing waste and emissions



Source: Cleaning up the textile industry, Specialist Printing Worldwide; 4:2017

Water minimization in printing

Modern Technology





Source: <https://www.fibre2fashion.com/industry-article/7713/growth-digital-textile-printing>

Water minimization in printing

Modern Technology

- ▶ Itaca (ink manufacturer) is one of the few that uses real numbers

	Water l/ m ²	Energy kWh / m ²	CO2 Kg CO2 /m ²
Rotary Reactive Printing	12,6	3,3	0,68
Digital Reactive Printing 	6,8	2,8	0,58
Digital Pigment Printing 	2,0	1,4	0,31

Source: From Green to Blue, a Path Towards an Eco Efficient Textile, Xavier Betoret Villalba, Itaca Textile

Helmuth Haas, AF Printing, CHT Group

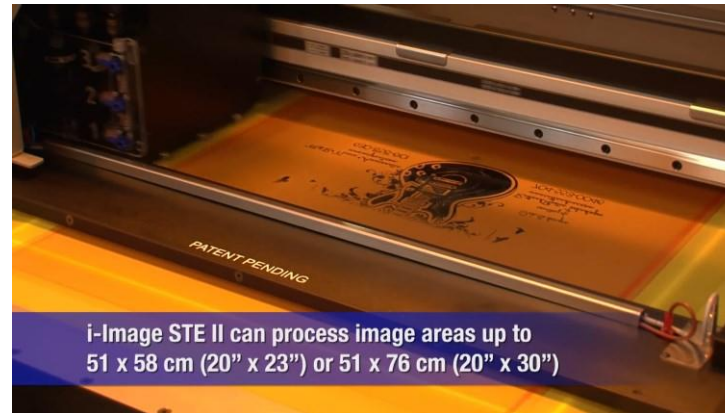
Water minimization in printing

Modern Technology



Automatic Coating

Eliminate Film



Automatic image creation

Reduce water usage



Wash with Eco-Rinse

Using modern machineries the usage of films can be eliminated **100%** and water usage can be reduced by up to **97%**

*Study calculations are based on 240 working days per year

Water minimization in printing

Computer-to-Screen

expose system (CTS)

A computer-to-screen system transfers images to the screens directly using only inkjet (black) inks



Water minimization in printing

Modern Technology - Automatic Screen Rinsing System



Eco-Rinse reduces water consumption because it's designed to apply the precise amount of water necessary to clean screens. While manual rinsing can consume as much as 10-15 liters (2.6-4.0 gallons) of water per screen, Eco-Rinse typically uses less than half that amount. Eco-Rinse also reduces operating costs by recycling water used in the wash cycle, further lowering per-screen water usage.

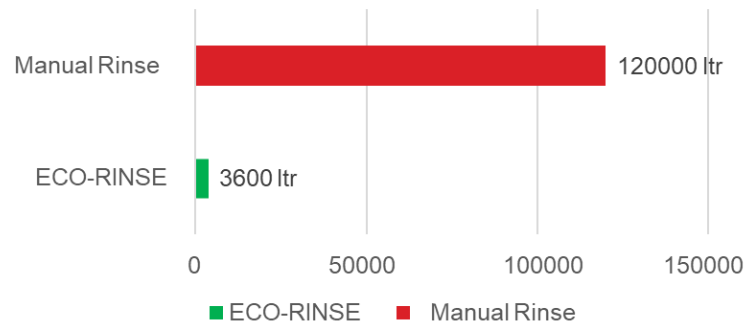
Characteristics

- Automates and simplifies one of the least-desirable aspects of the screen printing process
- Recirculates rinse water to reduce environmental impact and lower operating costs
- Eco-Rinse processes screens quickly, cutting per-screen labor costs by up to half

Water minimization in printing

Modern Technology - ECO-RINSE

Water consumption per year for 24000 screens



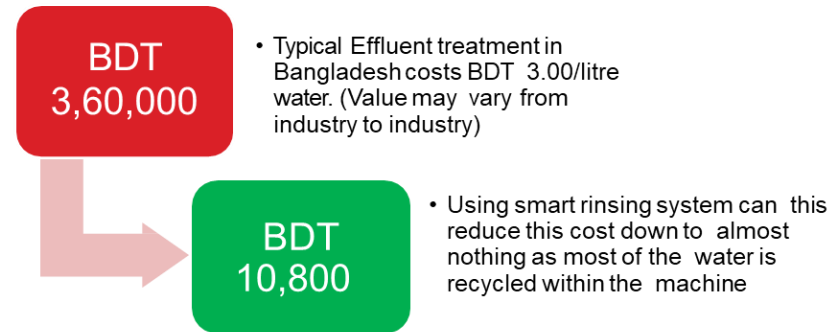
ECO-RINSE decreases water usage and ETP treatment cost by

97% per year

On a 100 screens per day basis

*Study calculations are based on 240 working days per year

ETP Cost Saving



Programmable, Semi-Automatic Operation for reduced labor cost and Maximum Efficiency.



Consistent and accurate washout of images assures consistency and ease of reproduction.



Step 4 of our Integrated 'Design to Press' System for maximum efficiency and productivity.

Source: Printing, CHT Group

Water Minimization in Printing

Modern Technology - 3D printed garment



Conclusion

- Printing processes
- Key points to consider
 - ✓ Implement low hanging fruits measures
 - ✓ Advanced technologies for low water footprints
 - ✓ Printing digitally on textiles without any effluent in a highly automated environment is possible today



Further Reading

- Sustainable Printing Solutions Seminar by CHT and RH Corporation, 11 August 2022
- https://learn.destexproject.eu/wp-content/uploads/2021/03/Inkjet-printing_UB.pdf
- https://gotxfabricprinter.com/eu/wp-content/uploads/sites/7/2014/10/How-Digital-Print-Works_10.14.pdf

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