Sustainable Innovation in Waterless Dyeing with SCF Technology

ELLIYAS MOHAMMED

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The Dyestuff Company

MAJOR CONCERN FOR TEXTILE INDUSTRIES

- Higher Water Consumption
- Higher Energy Consumption
- Higher CO_2 Emission

- Higher Effluent Generation
- Longer Dyeing Cycle
- Poor Reproducibility
- Intensive Labor

MAJOR CONCERN FOR TEXTILE INDUSTRIES

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Increasing Water Scarcity and Environmental Awareness Force to Adopt more Sustainable Technology.

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So, What if you could dye fabric without water ?

No Water

No Waste Water

Low CO_2 Emissions

Low Energy Consumption

No Chemicals & Additives

Complete Automation

WATERLESS DYEING TECHNIQUES

- ✓ Dyeing with Supercritical CO2
- ✓ Digital Printing
- ✓ Plasma Dyeing
- ✓ Transfer Printing
- ✓ Foam Dyeing

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DYEING WITH SUPERCRITICAL FLUID (SCF)

CARBON DIOXIDE IS:

NONTOXIC & NONFLAMMABLE

SUSTAINABLE & RECYCLABLE

INEXPENSIVE & ABUNDANTLY AVAILABLE

THE SAME QUALITY ANYWHERE IN THE WORLD

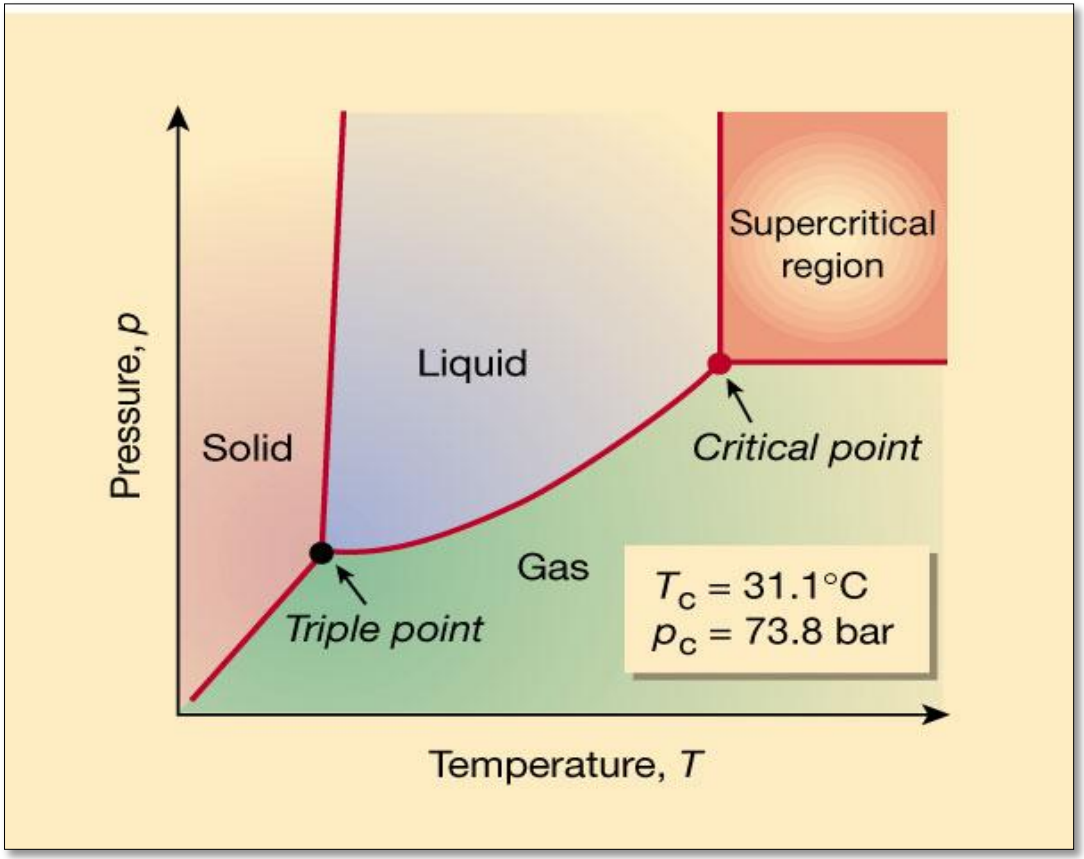
THE BEST OF BOTH WORLDS IN SUPERCRITICALPHASE (PERMEABILITY, DENSITY, CARRIER)

DYEING WITH SUPERCRITICAL FLUID (SCF)

SCF DYEING TECHNOLOGY DOES AWAY WITH

- **Use** of **TOXIC** components
- **Use** of **FRESH WATER**
- **LARGE WASTE** streams
- **HIGHER ENERGY** Consumption
- Intensive **LABOR**

DYEING WITH SUPERCRITICAL FLUID (SCF)



- Above 31°C and under 74 bar, CO_2 becomes supercritical - a state of matter that can be seen as an ‘expanded liquid’, or a ‘heavily compressed gas’.
- Unique Characteristic of Supercritical fluid is its high density that enables dissolution of compounds.

DYEING WITH SUPERCRITICAL FLUID (SCF)

- The supercritical fluid CO_2 causes the polymer fiber to swell allowing the disperse dye to easily diffuse within the polymer.
- This deep penetration provides effective coloration of hydrophobic polymers.
- Dyeing and removing excess dye are processes that are done in the same vessel.
- Residue dye is minimal and extracted, can be recycled.

BASICS OF SCF DYEING TECHNOLOGY

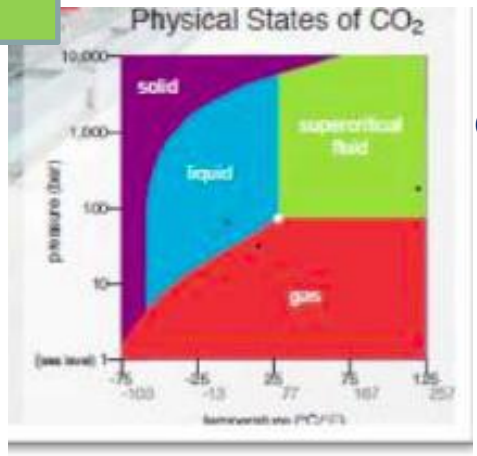
(250 bar/ 120°C)

5. Dyed Fabric

2. CO_2

1. CO_2 Storage

3. Dyeing Process



CO_2 > 95% recycled

CO_2 + < 0.02% of Dye

4. Separator Pressure Drop

WATERLESS DYEING SCIENCE

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ADVANTAGES

- Significant Lower Operational Costs
- Shorter Batch Time (up to 50%)
- Reduction in Energy Cost (40%)
- Zero Water Consumption
- Zero Waste Water
- Zero Processing Chemicals
- Zero Drying Cost for Dyed Fabrics
- 98% Colour Consistency
- Significant Less Re-dyeing
- EASY Colour Correction
- Above 95% CO_2 is Recycled

Quality

SCF Dyeing results are equal or better than Conventional dyeing in Leveling Color-fastness, washing, staining

Quality

Washing Fastness:- (**AATCC 2A)** at 49˚C/45 mins. AATCC Soap 0.15% Liquor 150 ml
Steel Balls 50 Nos.

YELLOW
Treated Shade

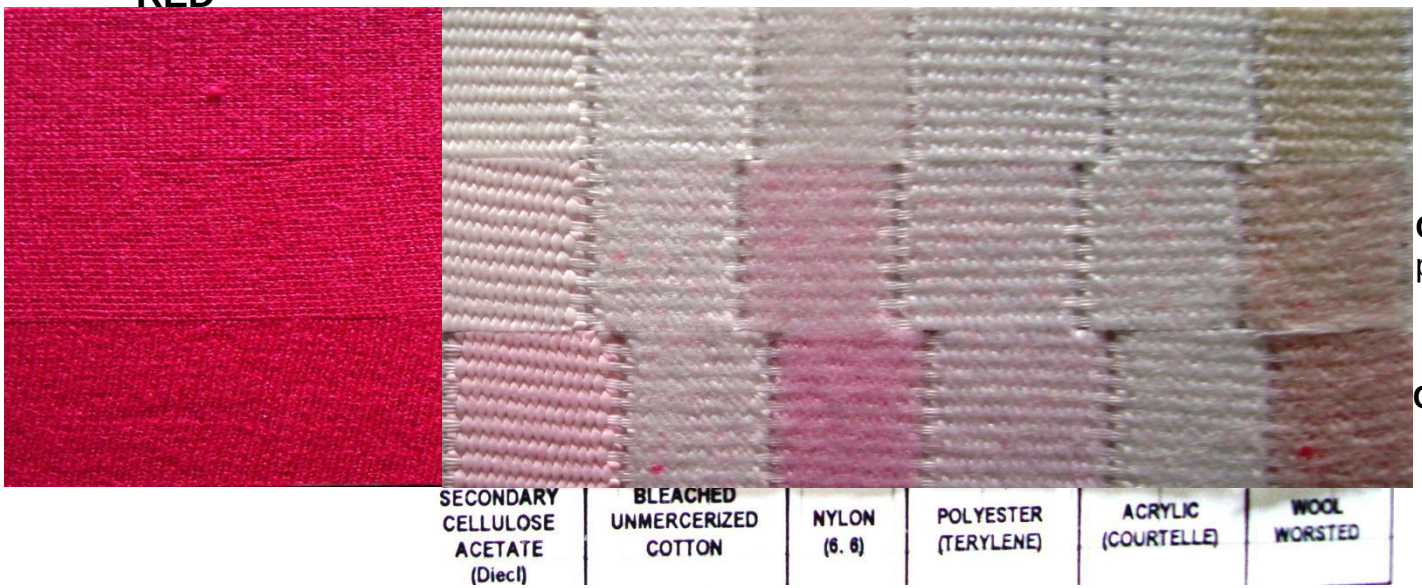
Staining on multifibre fabric

SCF Dyeing

Conventional Dyeing
post Heat setting at 110°C/30 Sec

Conventional Dyeing
post Heat setting at 180°C/30 Se

RED



SCF Dyeing

Conventional Dyeing
post Heat setting at 110°C/30 Sec

Conventional Dyeing
post Heat setting at 180°C/30 Se

Quality

Washing Fastness:- (**AATCC 2A)** at 49˚C/45 mins. AATCC Soap 0.15% Liquor 150 ml
Steel Balls 50 Nos.

BLUE

Treated Shade

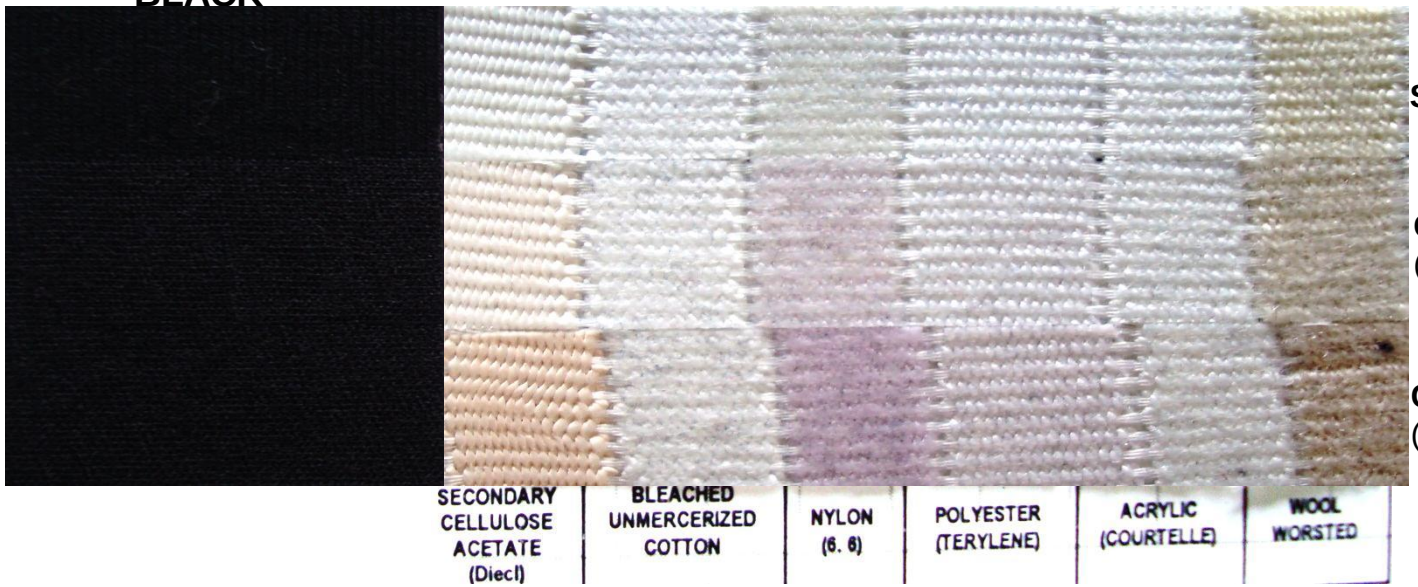
Staining on multifibre fabric

SCF Dyeing

Conventional Dyeing
(Post Heat setting at 110°C/30 Se

Conventional Dyeing
(Post Heat setting at 180°C/30 Se

BLACK

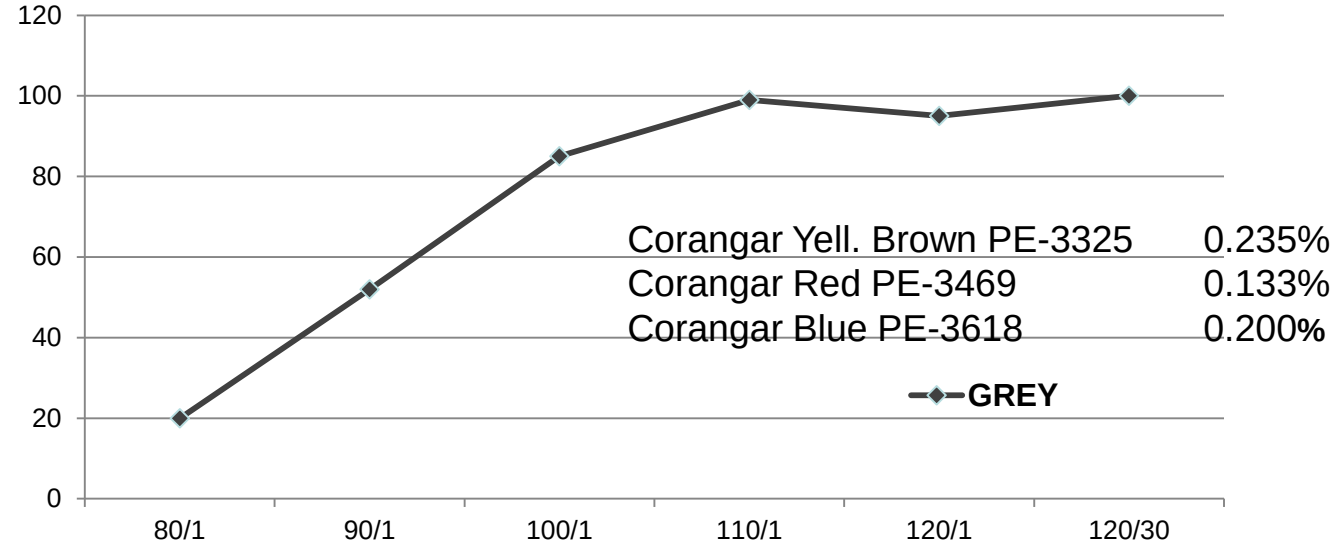


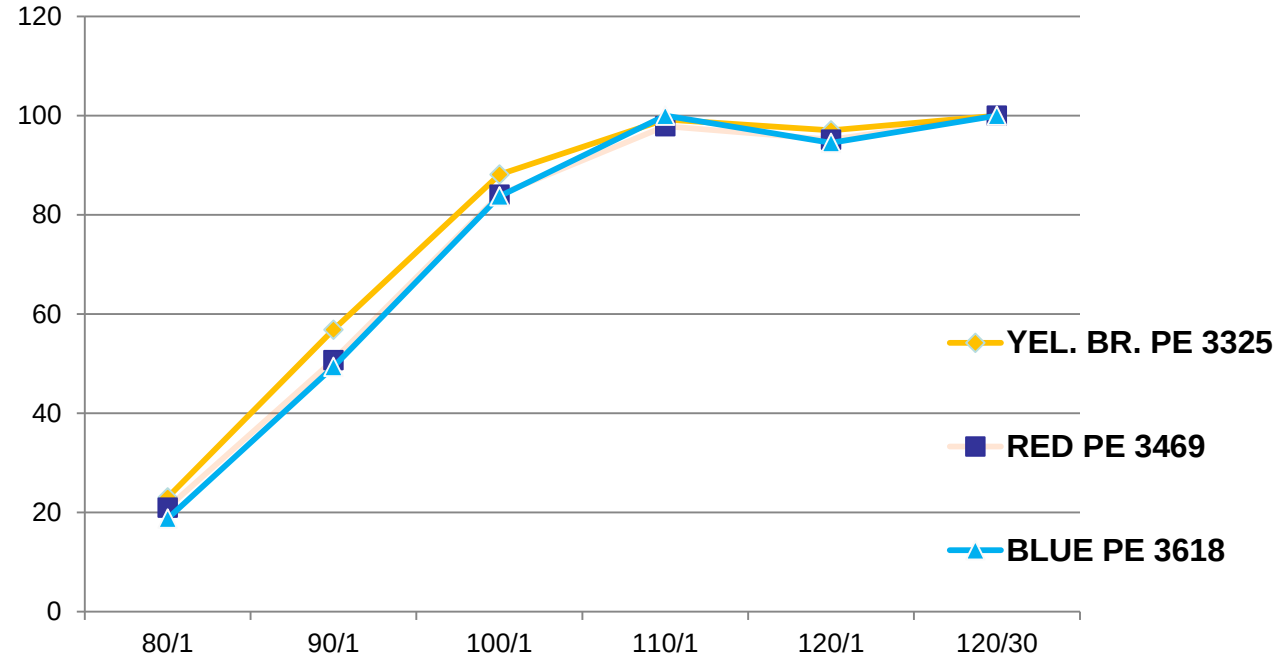
SCF Dyeing

Conventional Dyeing
(Post Heat setting at 110°C/30 Se

Conventional Dyeing
(Post Heat setting at 180°C/30 Se

Quality


120
100
80
60
40
20
0
80/1
90/1
100/1
110/1
120/1
120/30
Corangar Yell. Brown PE-3325 0.235%
Corangar Red PE-3469 0.133%
Corangar Blue PE-3618 0.200%
GREY


120
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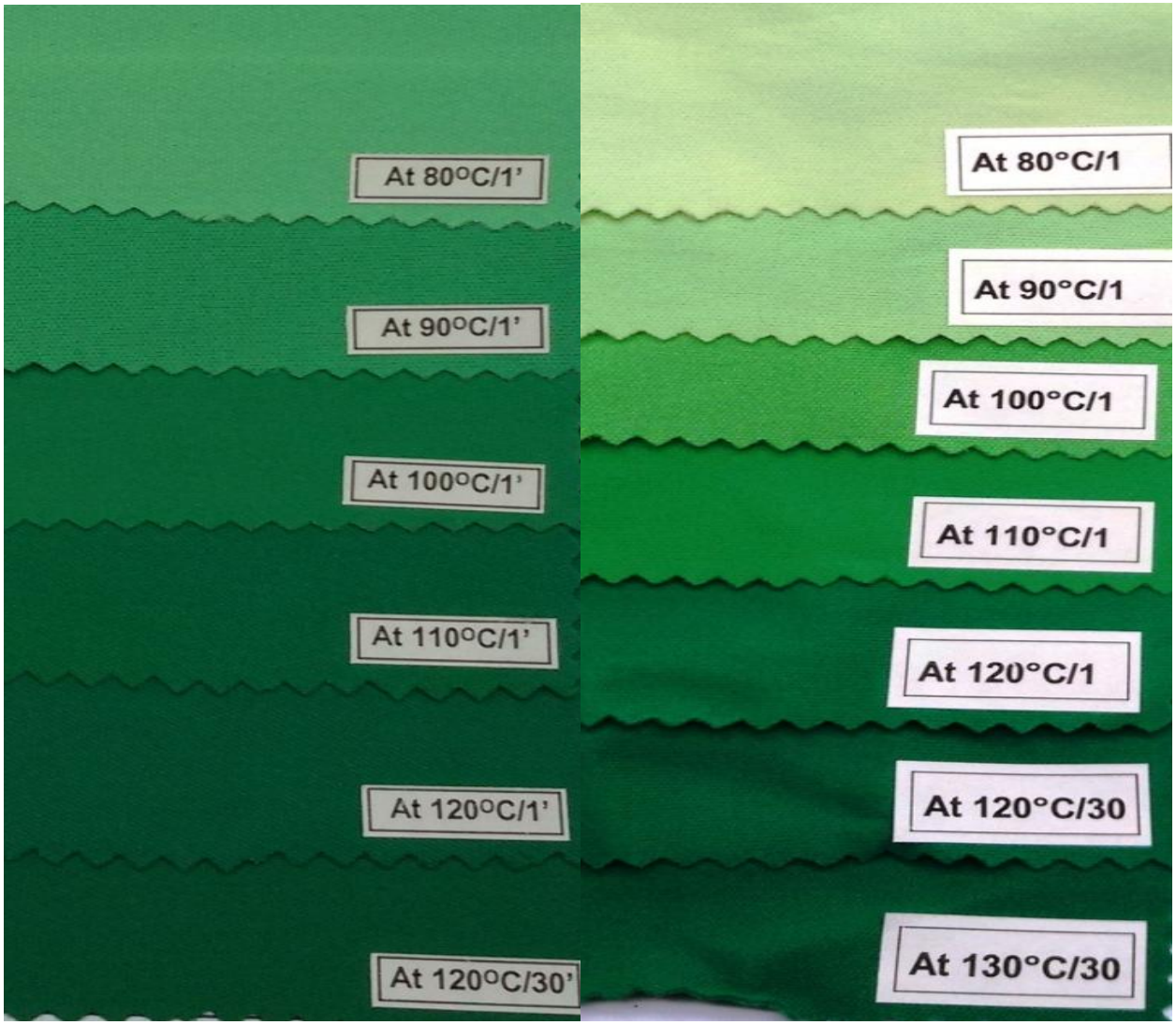
40
20
0
80/1
90/1
100/1
110/1
120/1
120/30
YEL. BR. PE 3325
RED PE 3469
BLUE PE 3618


At 80°C/1'
At 90°C/1'
At 100°C/1'
At 110°C/1'
At 120°C/1'
At 120°C/30'

Quality

Corangar Yellow PE-3279 : 0.25%
Corangar R. Blue PE-3688 : 0.245%

SCF DYEING



Conventional Dyeing

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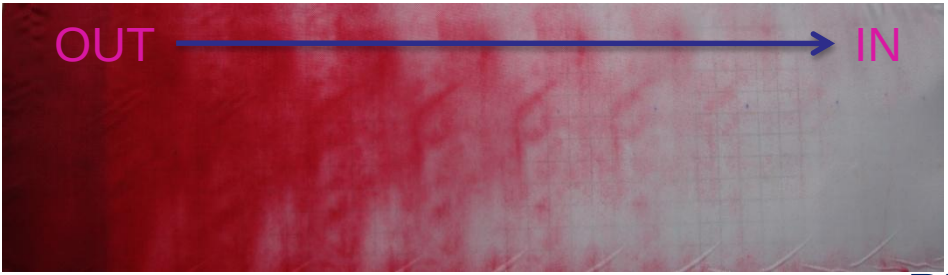
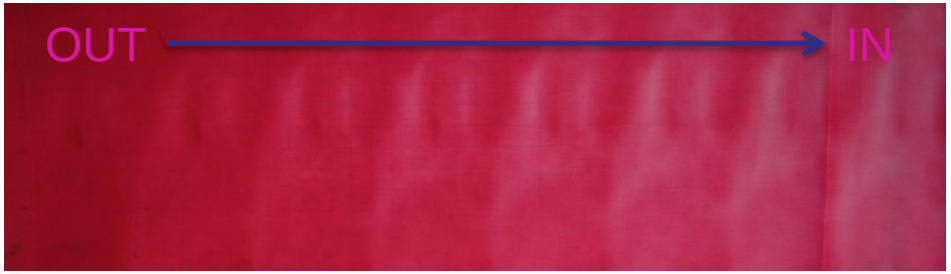
Coil Test for Migration Study

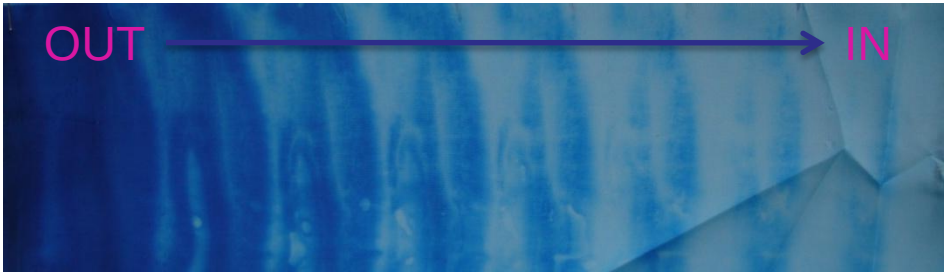
Conventional Dyeing V/S SCF Dyeing

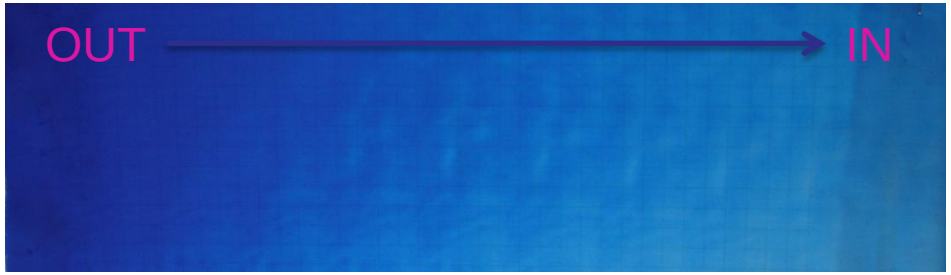
GREEN





RED

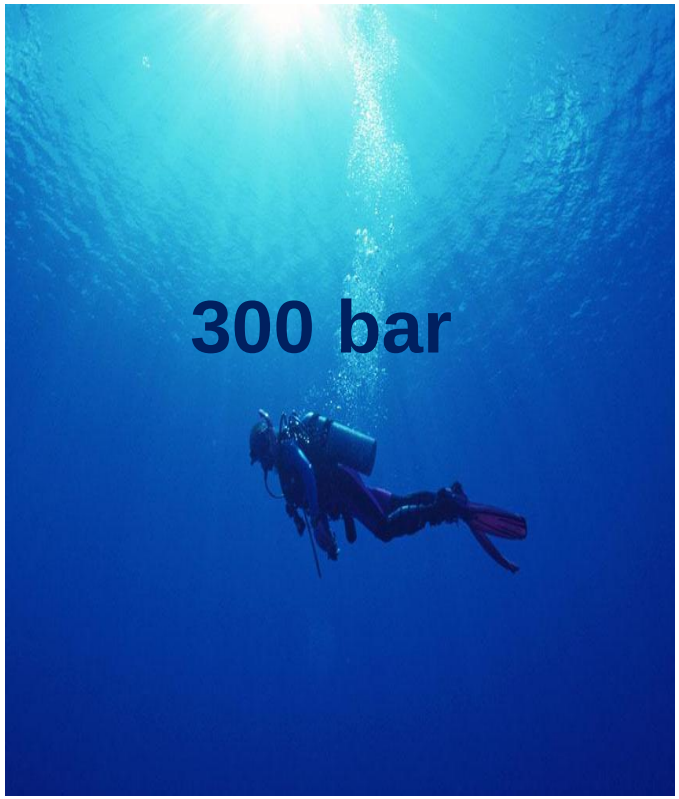




BLUE

Much Better dye migration (diffusion) in SCF Dyeing Compare to Conventional Dyeing

Safety



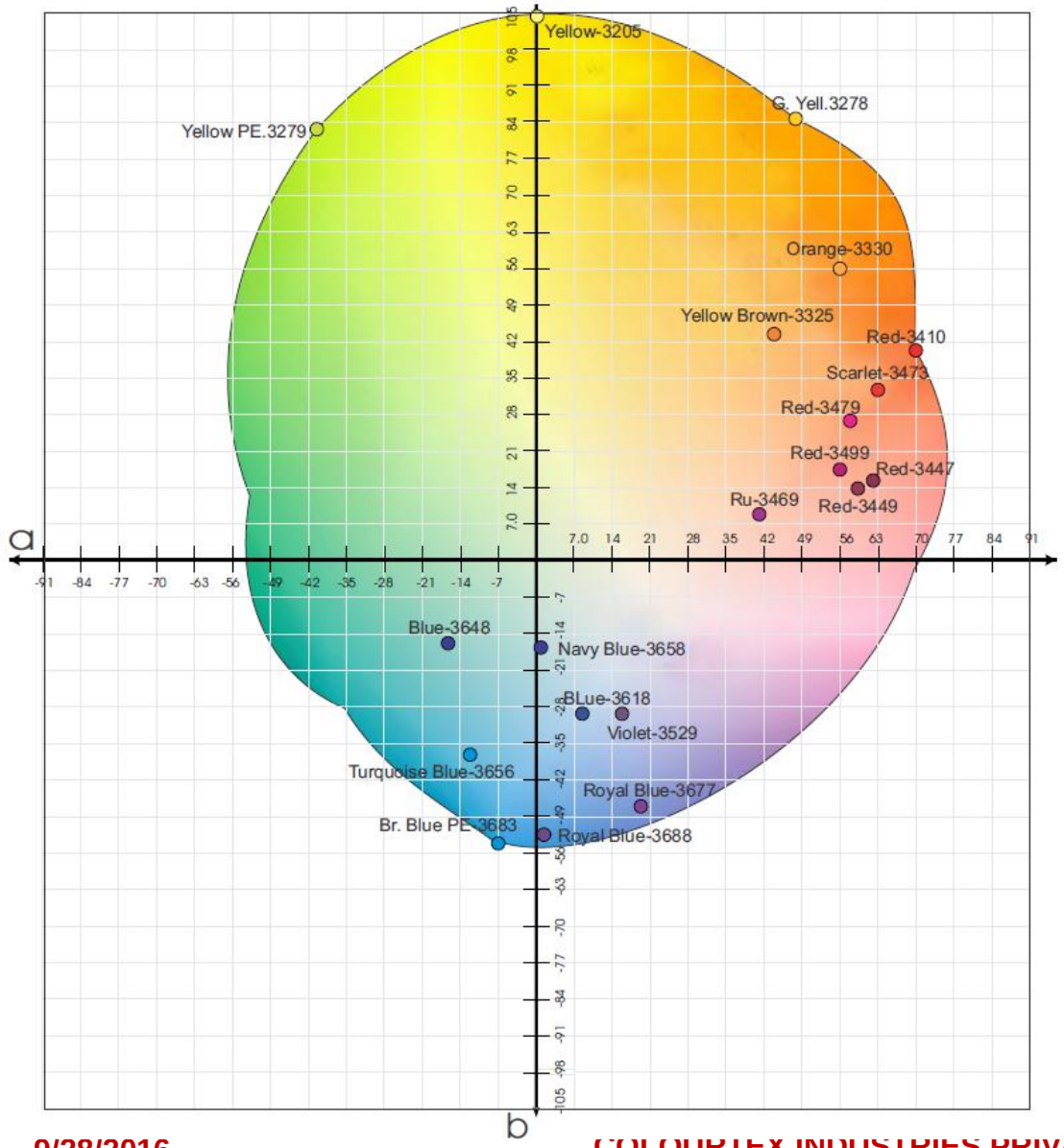
Control and Safety Loop

1. Control PLC
2. Safety PLC
3. Safety valves all over the machine
4. Operators, Emergency stop
5. CO_2 detection system
6. Fully comply with ASME design-code
7. Certified by BUREAU VERITAS & LLOYD'S

DYES FOR SCF DYEING TECHNOLOGY

CORANGAR PE:
Specially designed Dyes for polyester from Colourtex for SCF Technology from DyeCoo

DYES FOR SCF DYEING TECHNOLOGY



CORANGAR PE DYES ACHIEVE FULL COLOUR SPACE

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DYES FOR SCF DYEING TECHNOLOGY

SCF DYEING TECHNOLOGY- STATUS

Synthetics

currently
- 100% PES
- Woven / Knit / Micro

2015-2016
- YARN
- Polyamide
- Spandex

Cotton / Blends

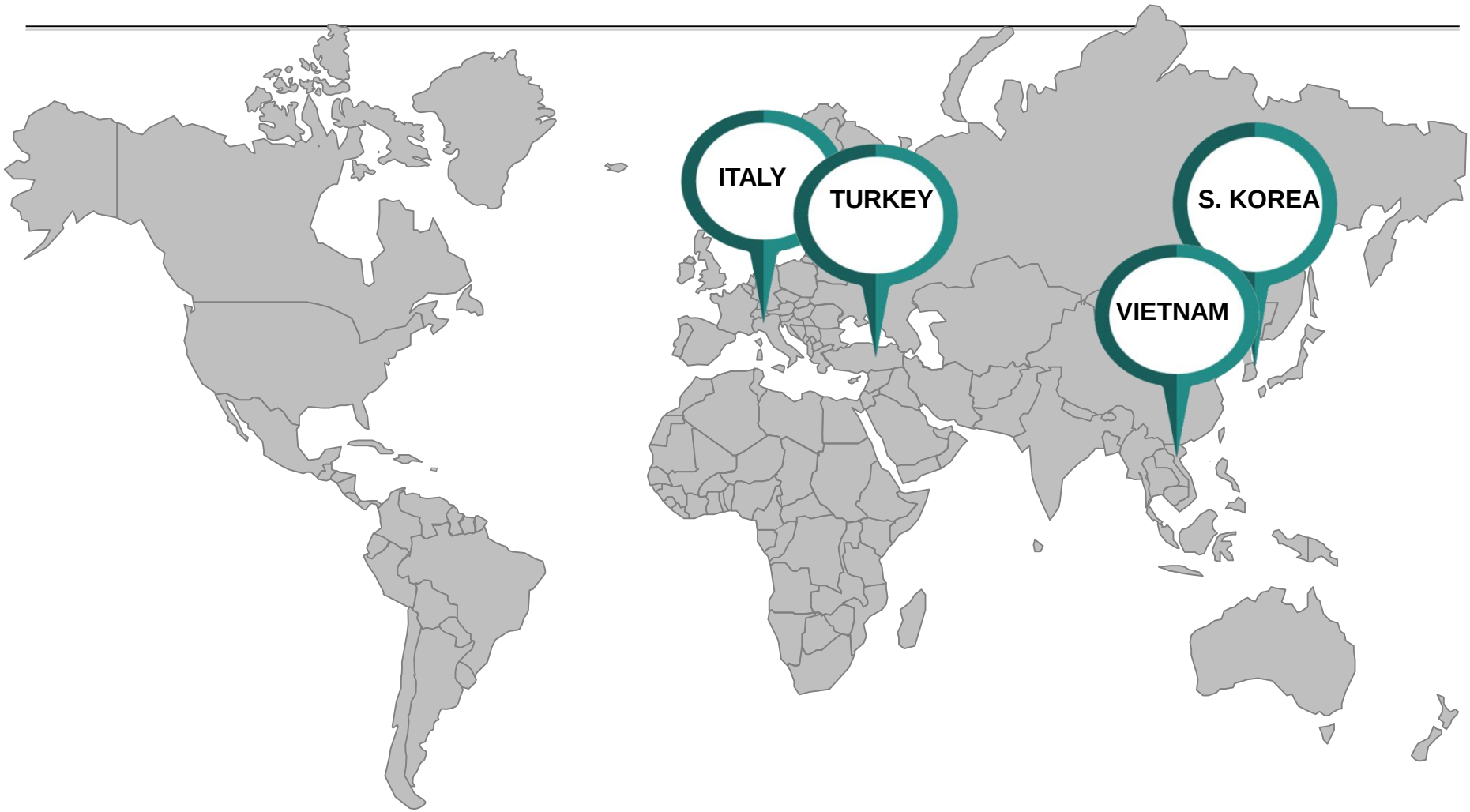
>2016

Niche markets

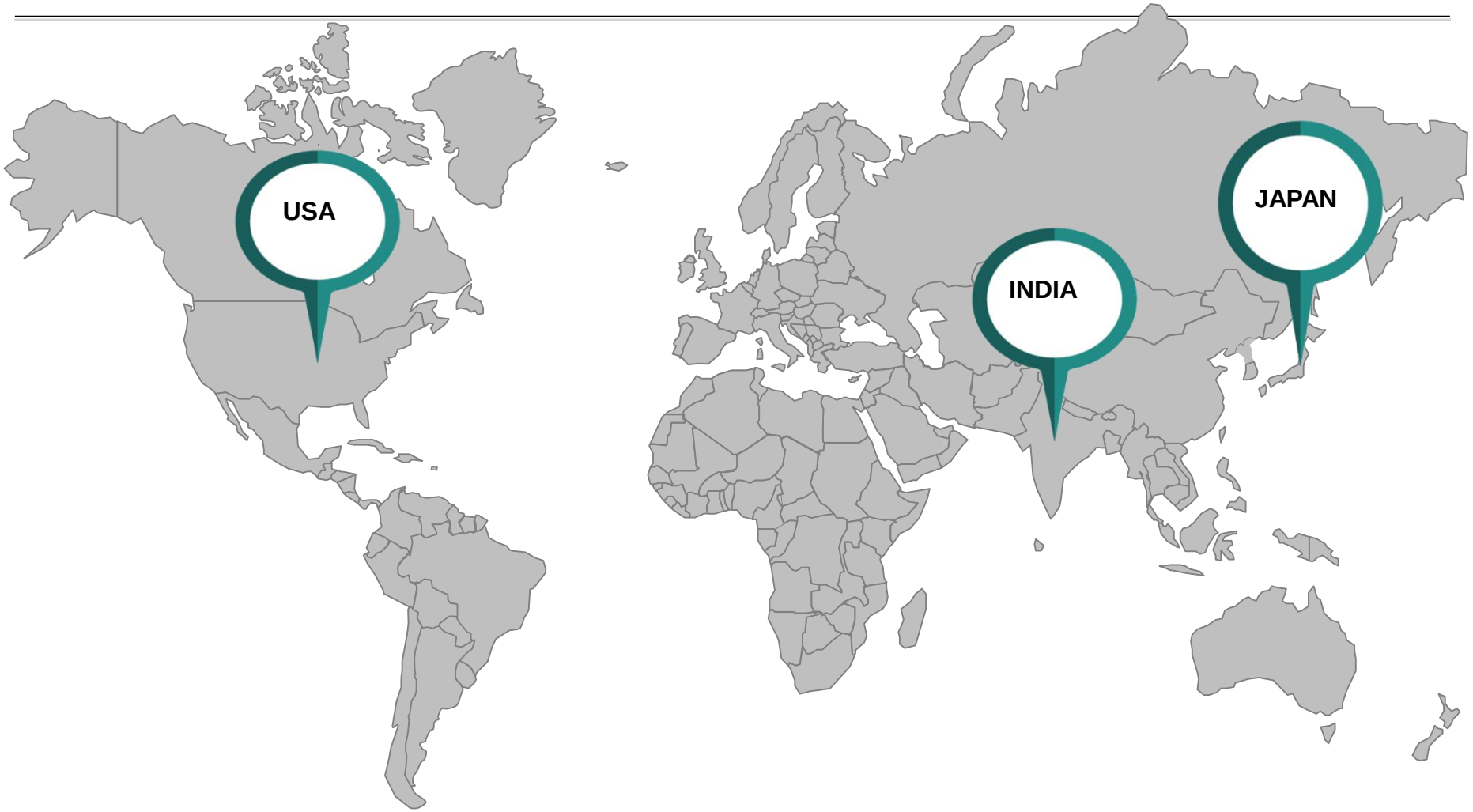
On Demand
- Leather
- Acrylics
- Silk

CURRENT INSTALLATIONS OF DYECOO SCF SYSTEMS

PHASE-1



PHASE-2



DYE HOUSE OF THE FUTURE

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“We are aspiring to become the most eco-friendly textile group providing DryDye fabrics and garments”

Mr. David Yeh,
Managing Director ,
Tong Siang Co. Ltd.

“We see this as an important step towards revolutionizing the textile dyeing industry. This product line proves that our technology is economical viable and suitable to scale, while hugely decreasing environmental impact”.

Mr. Mats Blacker
CEO,
DyeCoo

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Thank you

"While ultimate environmental impact of this innovation cannot be quantified at this stage, the use in textile processing of SCF – super critical fluids – has set the industry on a greener, more environmentally sustainable path,"
ELLIYAS MOHAMMED

member ETAD

Responsible Care®
OUR COMMITMENT TO SUSTAINABILITY

bluesign® SYSTEM PARTNER