Sustainable Innovation in Waterless Dyeing with SCF Technology

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MAJOR CONCERN FOR TEXTILE INDUSTRIES

• Higher Water Consumption
• Higher Energy Consumption
• Higher CO₂ Emission
• Higher Effluent Generation
• Longer Dyeing Cycle
• Poor Reproducibility
• Intensive Labor
Increasing Water Scarcity and Environmental Awareness Force to Adopt more Sustainable Technology.
So, What if you could dye fabric without water?

- No Water
- Low CO₂ Emissions
- No Chemicals & Additives
- No Waste Water
- Low Energy Consumption
- Complete Automation
WATERLESS DYEING TECHNIQUES

✓ Dyeing with Supercritical CO2
✓ Digital Printing
✓ Plasma Dyeing
✓ Transfer Printing
✓ Foam Dyeing
WATERLESS DYEING TECHNIQUES

- Dyeing with Supercritical CO2
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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 SUPERCritical PHASE
  (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**
Above 31°C and under 74 bar, CO₂ 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.
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

1. CO₂ Storage

2. CO₂

3. Dyeing Process

(250 bar/ 120°C)

4. Separator Pressure Drop

CO₂ + < 0.02% of Dye

5. Dyed Fabric

CO₂ > 95% recycled
WATERLESS DYEING SCIENCE
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% CO₂ 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 Sec

RED

SCF Dyeing

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

Conventional Dyeing
post Heat setting at 180°C/30 Sec
Quality

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

**BLUE**
- Treated Shade
- Staining on multifibre fabric

**BLACK**
- SCF Dyeing
- Conventional Dyeing
  (Post Heat setting at 110°C/30 Sec)
- Conventional Dyeing
  (Post Heat setting at 180°C/30 Sec)

9/28/2016
Quality

Corangar Yell. Brown PE-3325 0.235%
Corangar Red PE-3469 0.133%
Corangar Blue PE-3618 0.200%
Quality

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

Coil Test for Migration Study

Conventional Dyeing V/S SCF Dyeing

GREEN

OUT → IN

OUT → IN

OUT → IN

OUT → IN

RED

OUT → IN

OUT → IN

OUT → IN

OUT → IN

BLUE

OUT → IN

OUT → IN

OUT → IN

OUT → IN

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. CO₂ detection system
6. Fully comply with ASME design-code
7. Certified by BUREAU VERITAS & LLOYD’S
DYES FOR SCF DYEING TECHNOLOGY

Corangar Dyes

Exclusive range of colours for super critical Carbon dioxide dyeing of polyester

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
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

Taiwan

Thailand
PHASE-1
DYE HOUSE OF THE FUTURE
“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
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

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