SUBTLE TO STRIPED
Sustainable Fashion With Cationic Cotton
THE ULTIMATE TEXTILE RESOURCE
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CATIONIC COTTON

Technical Details
Application
Benefits
WHAT IS CATIONIC COTTON?

- Cationic cotton refers to cotton that has been chemically modified to possess a permanent cationic (positive) charge.

- Typical cationization reagent, 3-chloro-2-hydroxypropyltrimethylammonium chloride (CHPTAC).

- 1:1 equivalent NaOH to CHPTAC to form EPTAC.

![Chemical structures of CHPTAC and EPTAC]
REACH CERTIFICATION

• CHPTAC - Intermediate Registration

• http://echa.europa.eu/information-on-chemicals/registered-substances/-/disreg/substance/100.020.045

• http://echa.europa.eu/brief-profile/-/briefprofile/100.020.045#collapseSeven

• http://echa.europa.eu/brief-profile/-/briefprofile/100.020.045#SDe-RegistrantsSuppliers
CATIONIZATION PROCESS
APPLICATION PROCESS

• Versatile Chemistry
  – Can react with variations of time, temperature, and levels of caustic

• Many processes
  – Exhaustion, cold pad batch, pad steam, pad dry cure, combinations

• Apply to various cotton substrates
  – Fiber, yarn, or fabric

• The efficiency of the reaction and the resulting degree of cationization is directly related to the amount of quat applied and the substrate and process utilized
WHAT GOOD IS IT?

• From permanent cationic charges, traditional dyeing of cotton goods can now be accomplished:
  – Without the need for salt,
  – Up to 100% dye utilization of anionic dyes (mainly acid, direct, reactive)
  – With reductions in consumables such as energy, water, and steam,
  – Overall cost savings are possible
    • Will become more important as reactive dye prices increase

• Dyestuff Reduction
  – Related to dyes used, dye process, liquor ratio, shade
COMPARISONS

Traditional Reactive Dyeing

Cationic Reactive Dyeing

Cationic End Dyebaths

LEVEL OF CATIONIZATION

• If buying from a supplier, the supplier may offer several levels of 100% cationic yarn or blended yarn
  – If treating in house, have control of the level of cationization
• The higher the level of cationization or blend of cationic fiber, the more dye the fiber can hold

![Increasing Cationization]

- Low
- Medium
- High
TRADITIONAL DYEING OF COTTON

Cotton Fiber
Cross-sectional view

Fiber Reactive Dye

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TRADITIONAL DYEING OF COTTON

Cotton Fiber
Cross-sectional view

Salt

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TRADITIONAL DYEING OF COTTON

Cotton Fiber
Cross-sectional view

Fiber Reactive Dye
TRADITIONAL DYEING OF COTTON

Dyed Cotton Fiber
Cross-sectional view
DYEING OF CATIONIC COTTON

Cotton Fiber
Cross-sectional view
DYEING OF CATIONIC COTTON

Cationic Treated Cotton Fiber

*Cross-sectional view*
DYEING OF CATIONIC COTTON

Cationic Treated Cotton Fiber

Cross-sectional view

Fiber Reactive Dye

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DYEING OF CATIONIC COTTON

Cationic Treated Cotton Fiber
Cross-sectional view

Fiber Reactive Dye

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HOW TO DYE

• Challenge: To control dye strike rate for blended yarn and/or 100% cationic yarn of fabric
  – Too rapid dye strike results in un-level fabric
  – Generally, lower temperatures and slow dye addition slow strike rate
  – If shade depth and cationization level are comparable, easier to control the dyeing process
    • As good or better fastness properties can be obtained with cationic cotton because of ionic and covalent bonding
• Dye Processes
  – Best suited for exhaust batch dyeing, either piece or garment
CATIONIC COTTON DEVELOPMENTS

• Area where Cotton Incorporated continues to research and develop
  – Funded multiple research projects around cationic cotton
    • Deep blacks, capping and modeling, dyeing processes for cationic cotton, simultaneous preparation and cationization, MS and PhD thesis
    • Written papers on reducing the odor of cationization, predicting dyeing and cationization recipes, how to obtain deep black cotton shades, how to dye cationic cotton
  • ColorZen
• Evaluation of new cationic chemistries resulting in new cationic cottons
  – Impart new functionalities to cotton fabrics with new cationic cotton
CATIONIC COTTON
Sustainability Opportunity
Inventory Advantages
Design Possibilities
REDUCED WATER, ENERGY, & CHEMICALS

- Salt and alkali not needed to dye cloth
- Color adheres to fabric quickly
- Less dye needed to achieve same color
- Less effluent left in dye bath
INVENTORY ADVANTAGES

- Can be piece or garment dyed
- Reduction in product SKUs
- Minimized forecasting risk
- Reduced package-dyed yarn inventories
- Quick replenishment of product
DESIGN POSSIBILITIES

• Solids & stripes
• Color and white
• Heathers & melange
• Gradient effects
• Tone on tone
• Texture
• Jacquards
• Colored warps
• Print effects
DESIGN & INVENTORY ADVANTAGES
Versatility in All-Over Heathers

PFGD BLANK

COLOR POSSIBILITIES FROM ONE SKU
DESIGN & INVENTORY ADVANTAGES

Versatility in Colored Stripes

PFGD BLANK
BEFORE & AFTER

Greige Fabric

Dyed Fabric

SUBTLE TO STRIPED: Sustainable Fashion With Cationic Cotton
Heather Jersey
Rainbow Heather Jersey
Fine Texture with Heather Yarn
Pinstripe Heather
Multi-tone Striped Jersey
Textured Stripe
Color and White “Yarn Dye Like” Effects
Heather Twill Look
Speckled French Terry
Striped French Terry
Jacquard Cationic Treated Fill
Jacquard Cationic Treated Fill
Double-Sided Look
Dobby Pick-Stitch with Cationic Treated Slub Yarn in Fill
Plain Weave Filling Stripe of Cationic Treated Heather Yarn
Striped Texture with Space Dyed Novelty
Plain Weave Cationic Treated Warp
Twill Cationic Treated Slub Filling
3x1 Twill with Cationic Treated Warp
Twill with Cationic Treated Warp | Discharge Print
Twill Cationic Treated Warp | Discharge Print
Discharge Printed Tonal Fine Gauge Knit
CATIONIC COTTON

Suppliers
Summary
Q&A
SUPPLIERS

FIBER

TINTORIA PIANA US
Cationic Treated Fiber
www.tintoriapiana.com

COLORZEN
Cationic Treated Fiber
www.colorzen.com

YARN

ProTura™ Yarns
www.tuscarorayarns.com

EcoFresh™ Yarns
www.bros.com.cn

FABRIC

Cationic Colored Denim
www.conedenim.com

Cationic Treated Woven Greige Goods
www.inmanmills.com

Cationic Treated Knits

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Find this webinar at CottonUniversity.org

Look for this webinar course in the Spotlight or The College of Dyeing

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Webinar slides for download + Additional Q&A + Supplemental material