Chemistry is the new black

Amanda Cattermole

Marty Mulvihill
# Chemistry in the Textile Supply Chain

## Step 1: Yarn
Oils to reduce friction during spinning

## Step 2: Fabric Production
Sizing chemicals, lubricants, solvents such as benzene, adhesives, and binders

## Step 3: Pre-Treatment
Surfactants such as alkylphenol ethoxylates, solvents, bases for cleaning fabric, bleaches to prepare for dyeing

## Step 4: Dyeing and Printing
Heavy metal fixing agents and dyestuffs, polymers and plasticizers for printing, detergents

## Step 5: Finishing
Softening using ammonium compounds, silicones, polyurethanes; crease resistance using a formaldehyde-based resin; water and stain resistance using fluorocarbons

Source: C&E News
HAZARDOUS CHEMICALS IN TEXTILES

Manufacturing textiles from fiber to finished fabric is a long process that uses lots of chemicals and water resulting in polluted waterways and exposure to workers and their communities. Greenpeace has identified 11 classes of hazardous chemicals – but there are many more:

- Alkyl Phenols used in detergents
- Phthalates used in printing
- Halogenated flame retardants
- SOME azo dyes
- Organotin compounds – biocides, catalysts in plastic and glue production and polyurethane products
- Perfluorinated chemicals for stain and water repellency
- Chlorobenzenes – dye carriers for polyester and solvents, degreasing skins
- Chlorinated solvents – used for cleaning and dissolving fats, oils and adhesives
- Chlorophenols – preservatives and pesticides
- Short chain paraffins
- Heavy metals – many uses
BRAND RESPONSES TO CHEMICALS OF CONCERN

- Awareness and Transparency
- Restricted substance lists
- Preferred substances and chemical screening
- Product and brand redesign
Challenge:
To develop fabric finishing technologies that avoid the use of hazardous chemicals.

**TRADITIONAL CROSSLINKING**

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\text{wrinkle resistance} \quad \text{DWR} \quad \text{water repellency}
\]

**NATURAL CROSSLINKING**

[Images of natural elements and their corresponding crosslinking properties]
TRENDS IN THE INDUSTRY

• COLLABORATION
  • AFIRM, ZDHC, OIA

• TRANSPARENCY
  • Products
  • Supply chains
  • Chemicals

• CIRCULAR BUSINESS MODELS
  • Take-back
  • Repurposing
  • Zero waste

• GREATER INVESTMENT IN INNOVATION INCLUDING GREEN CHEMISTRY
  • Fashion for Good
  • Levi’s Collaboratory
  • H&M Global Change Award
  • Patagonia Tin Shed
SAFER CHEMISTRY INNOVATION AREAS IN TEXTILE, APPAREL, AND FOOTWEAR

**New Materials**
- Synthetic Fibers
- Cellulosic Fibers
- Leather Alternatives

**New Safer Chemistries**
- Sustainable Finishing Chemistries
- Bio Based Dyes

**Waterless Processing**
- Waterless Dyeing Processes
- Waterless Finishing Processes

**Fiber Recycling**
- Cotton
- Polyester
- Nylon
- Blends

**Supply Chain Information Management Systems**
- Chemicals Management Information Systems
- Traceability Systems
LESSONS LEARNED-WHAT WORKED

How do you successfully collaborate between industry and the university?

• Good chemistry is a benefit – we like each other!
• Information exchange is the basis for lasting relationships
• Be humble, be patient, be open to new opportunities
• Start small-Lecturing, Greener Solutions, Consulting (student-participation desirable)
• Students are the Universities most valuable asset
• Engage multiple industries and funders to support on-going projects (don’t expect a golden ticket)
• Share, Share, Share, Try to structure relationships and consulting products so that the results can be in the public domain
• Funding opportunities
• We have both come so far.....