CELLULOSE FABRICS – CARRIERS OF VITAMIN E?

Tanja PUSIC, Sandra BISCHOF, Iva MATIJEVIC & Edita VUJASINOVIC

University of Zagreb, Faculty of Textile Technology
Textile functionalization
Textiles functionalization

Cosmetotextiles

- Moisturizers
- UV protection agents
- Antioxidants
- Bleaches and wrinkle-recovery agents
- Fragrances and perfumes
- Anti-cellulite agents
- Antimicrobial agents
- Refreshing and revitalising agents
Cosmetotextiles

- Natural substances like *rose oil, mint extract, aloe vera* or *vitamin E* through controlled release to the skin can provide benefits that consumers can feel (in therapeutic or cosmetic way).

- There are essentially two different ways of manufacturing cosmetic textiles, they are the binding of microencapsulated cosmetic components or the fabric coating by active finishes.
**Experimental**

- **Vitamin E (α-Tocopherol)**
  - In the cosmetic industry vitamin E is used as antioxidant and active substance among others because of its moisture binding capacity in aliphatic cosmetic creams, lotions, emulsions, body and face oils for dry skin care as well as for decorative cosmetics like lipsticks. It is also successfully applied for various skin diseases.

- Amphipathic and lipid-soluble compound
- Easily oxidized when subjected to heat, light and alkaline conditions
- Consist of a polar (hydrophilic) chromanol ring and an apolar (hydrophobic) 16-carbon side chain attached to the ring via the C-2 atom having saturated phityl side chains

*Present in nature, e.g. vegetable oil and nuts*
Experimental

<table>
<thead>
<tr>
<th>Technical parameter</th>
<th>Cotton</th>
<th>Viscose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weave</td>
<td>Plain</td>
<td>Plain</td>
</tr>
<tr>
<td>Mass per unit area (gm⁻²)</td>
<td>177</td>
<td>141</td>
</tr>
<tr>
<td>Warp yarn density (cm⁻¹)</td>
<td>25</td>
<td>36</td>
</tr>
<tr>
<td>Weft yarn density (cm⁻¹)</td>
<td>25</td>
<td>28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product</th>
<th>Chemical composition</th>
<th>Concentration (g/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NouWell E</td>
<td>Cyclodextrine-α-tocopherol complex</td>
<td>50</td>
</tr>
<tr>
<td>Sarabid OL</td>
<td>special alkyl polyglycol ether</td>
<td>3</td>
</tr>
<tr>
<td>Arristan PMD</td>
<td>microdispersion of modified polyurethane</td>
<td>45</td>
</tr>
<tr>
<td>Tubingal SMF</td>
<td>microemulsified functional polysiloxane</td>
<td>35</td>
</tr>
</tbody>
</table>
Procedures

- Padding process was applied on a laboratory foulard
  - with liquor pick-up of
    - 90% for cotton and
    - 97% for viscose fabrics.
  - Treated samples were dried for 2 min at 110°C and cured for 60 seconds at 150°C.
Procedures

- Washing process was performed in Linitest
- Bath ratio 1:20
- Temperature 40°C
- Standard detergent ECE A in a concentration 2.5 g/l
- 5 cycles
Methodes

- **Microscopy**
  - Scanning Electron Microscope (MIRA\FE-SEM, Tescan, Czech Republic). The specimens were sputter-coated with a palladium-gold alloy. The coated samples were then analyzed using the SEM operating at an accelerating voltage of 10.00 kV and magnification of 1000 x.

- **Streaming potential**
  - The streaming potential method was applied for surface characterization of the cellulose based fabrics. The samples were placed in the adjustable gap cell (AGC) of an EKA, Electrokinetic Analyzer, A. Paar, Austria.
Methods

- Detection of vitamin E by drop test

Reaction mechanism

a. redox

b. complexation
Results

- Qualitative determination of vitamin E

- Detection of Vitamin E by drop test was done on treated cotton and viscose fabrics before and after 5 washing cycles

![Images showing treated and washed cotton and viscose fabrics](image-url)
SEM images of fabrics magnification 1000X

**COTTON**  
Untreated

**VISCOSE**  
Treated with cyclodextrine-vitamin E complex

Treated with cyclodextrine-vitamin E complex after 5 washing cycles
Zeta potential of untreated and functionalised COTTON fabrics before and after washing versus pH of a 1 mmol/l KCl

- Surface charge of cotton fabrics treated with vitamin E – cyclodextrine complex is less negative than a surface charge of initial untreated cotton fabric \(\Rightarrow\) presence of hydrophobic substances onto surface
- Functional polysiloxane softener - responsible for a surface characteristic of cotton fabric treated with Vitamin E
- Decrease of finish deposits in alkali detergent bath
Untreated viscose materials are characterised by higher hydrophilicity than cotton resulting in lower surface charge.

Cosmeto finish further decrease zeta potential of viscose fabric.
Zeta potential of tested fabrics at pH 9

- After 5x washing cycles zeta potential value of treated samples are almost near initial values of untreated fabrics ⇒ **low persistence**

Despite this former titration curve for treated viscose fabric after washing showed opposite trend below pH 8 ⇒ **medium persistence**
CONCLUSIONS

- Identification of \( \alpha \)-tocopherol on functionalised cotton and viscose fabric before and after washing by drop test (iron (III) chloride in combination with dipyridil) proved to be quick and easy qualitative method.

- Streaming current method prove to be convenient not only for qualification but also for cosmeto-finish durability.

- Surface characterisation of cotton and viscose fabrics by SEM proved to be comparable with results obtained by streaming current method.

- Both methodologies proved to be convenient for a pre-characterization of cosmeto-textiles.

- Functionalization of cotton and viscose fabrics with Vitamin E was efficient and partly persistent in washing.

- Further analytical technique recommended for quantification of \( \alpha \)-tocopherol on cosmetic textiles as well as life-time in washing will be HPLC method.
Thank you for your attention!