Development of Surface Coating Procedures in Cotton Yarns/Fabrics for Single Stage Dyeing with Reduced Environmental Impact

http://chromasurf.iceht.forth.gr/index.php/en/

- **ChromaSurf brings into collaboration laboratories belonging to two different research organizations possessing strong background on synthesis/modification of functional polymers and on characterization of materials/surfaces (namely, the University of Patras and FORTH/ICEHT respectively) as well as three industrial partners that are specialized on cotton products, knitwear and dyeing (SOULIS-Kuehnis, ELVIFA and COLORA, respectively) and finally one laboratory dedicated to testing and certification of industrial and consumer products (MIRTEC).**

- **The main target is to develop coatings by depositing aqueous solutions of suitably designed multifunctional polymers in order to chemically modify surfaces used in the industrial textiles, focusing mainly on cotton substrates. The most ambitious goal is an integrated strategy solution that enables the adaptation of the new knowledge into the production process leading to innovative products with novel / improved features and high added value which can be exploited by the industries involved in the project.**

- **The proposed polymers will have at least three functions:**
  - ✓**charge inversion of the cellulosic substrate using cationic groups,**
  - ✓**covalent attachment to the cotton surface using reactive groups (epoxide, vinylbenzyl chloride)**
  - ✓**water solubility, so that the chemical modification of the cellulosic surfaces can be carried out in aqueous systems; a requirement particularly desirable for both economic and environmental reasons. The main innovation sought is the use of polymeric pre-treatments of cotton substrates, mainly cotton yarns, so that after their weaving, a graduated dyeing capacity will be achieved by immersion in a single dyeing bath.**

- **Furthermore, ChromaSurf sets out a series of ambitious targets, such as optimization of polymers and cotton surface modification processes (to control dye uniformity, optimize chemical modification efficiency and dyeability), expansion of polymer modifiers in the direction of natural polymers (chitin, chitosan), demonstration of new functions such as biostatic action and the extension of dyeing applications using alternate categories of dyes.**

- **The optimization of the modification process is strongly supported by extensive characterization of the modified and dyed cotton substrates. Characterization, based on surface techniques (such as ATR/FTIR, confocal Raman spectroscopy, XPS) targets at:**
  - **(i) evaluation of the dyes-polymer & polymer-cotton interactions**
  - **(ii) estimation of the modification level which is important for both practical and economical reasons (achieving uniform colour, using the minimum amount of polymer modifier)**

Modification and dyeing of cotton fabrics with cationic polymers

Before After

Remazol Brilliant Blue R

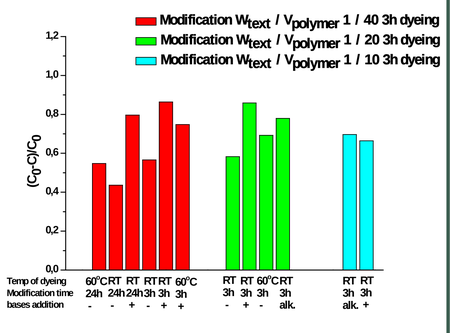
Novacron Dark Blue S-GL

Novacron Ruby S-3B

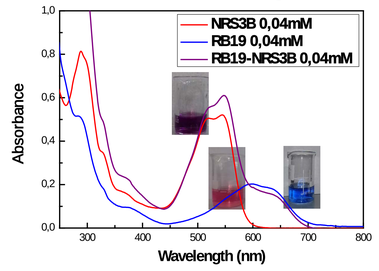
Aqueous polymeric solution (1% w/v)
Temperature : 60°C or room temperature
Time: minutes to 24h
Neutral or alkaline (NaOH) conditions

Aqueous dye solution (0,0025% w/v)
Temperature : 60°C or room temperature
Time: minutes to 24h
Neutral or alkaline (Na_2CO_3/NaOH) conditions

Dyeing conditions overview



Mixtures of Dyes



Blue Dye

Mixture

Red Dye

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