Structural and molecular characterization of modified and dyed cotton yarns

K.T. Papapetros [1,2#], **K.S. Andrikopoulos** [1], **A. Soto-Beobide** [1], **Z. Lada** [1,3] and **G.A. Voyiatzis** [1*]

[1] FORTH/ICE-HT, Stadiou str, Rio-Patras, Greece

[2] Department of Chemical Engineering, University of Patras, Rio-Patras, Greece

[3] Department of Chemistry, University of Patras, Rio-Patras, Greece

Presenting author: Konstantinos. T. Papapetros, email: kpapapetros@iceht.forth.gr
* Corresponding author: G. A. Voyiatzis, email: gvog@iceht.forth.gr

ABSTRACT

Textiles and clothing is a very important industrial sector in Greek economy. The necessity of low cost and high added value products, e.g. multifunctional textiles, is a prerequisite for the competitiveness of the sector.

The general target of the ChromaSurf project is to develop suitably designed multifunctional polymeric coatings in order to chemically modify textiles' surfaces, focusing on cotton substrates. The main goal of this project is that after weaving, the pre-treated cotton yarns will be able to get a gradual dyeing by using a single dying bath. In order to get the desirable graduated capacity, new challenges arise. Controlling dyeability and dye uniformity may be achieved by the chemical modification efficiency of the cotton fibers (using specifically designed co-polymer modifiers [1]) and requires the optimization of the modification and dye processes.

Intermolecular interactions between the cotton substrate and the modifying co-polymers, and also between dyes and these co-polymers must be clarified and analyzed in qualitative and quantitative terms. Characterization of pristine yarns, modified yarns and dyed products at molecular level may elucidate the mechanisms of the respective processes. Molecular vibrational spectroscopies (such as micro-Raman and ATR/FTIR [2,3]) and other techniques such as XPS, are used in order to suitably characterize laboratory and industrial samples. The depth from which characterization of materials at molecular level is obtained differs for each of the previously mentioned surface techniques. Our results indicate that ATR/FTIR is suitable but only for the heavily modified yarns. Characterization of yarns that are designed and processed with low amount of polymeric modifiers and subsequent dyeing can be achieved only by micro-Raman spectroscopy, while the effectiveness of XPS for the information related to the modification and dyeing processes of yarns is validated.

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