

# Application of Enzyme Technologies in Finishing of Cellulosic Fabrics - From Theory through Practice

Emília Csiszár

Department of Physical Chemistry and Materials Science, Budapest University of Technology  
and Economics, H-1521 Budapest, P.O.Box 91.  
ecsiszar@mail.bme.hu

## *Abstract*

The serious waste water pollution caused by traditional textile finishing has oriented the research towards application of enzymes in textile wet processes. Since the early 1990s different enzymatic processes have been developed for wet processing of textile goods in wide-ranging operations from cleaning preparations to finishing processes. Cellulases, hemicellulases and pectinases acting on native cellulosic fibers became the target enzymes in textile bioprocessing.

We have been doing research in the field of textile biotechnology for about 12 years. Our primary research interest is in the area of biopreparation with special emphasis on cotton fabric. Enzymatic biopreparation of cotton is an environmentally-friendly alternative to the conventionally alkaline scouring for removing the non-cellulosic “impurities” (i.e. waxes, pectins, proteins, lignin-containing impurities and colouring matters, etc.) from greige cotton. Our research thrusts cover the application of commercial hydrolytic enzymes, such as cellulases, pectinases and xylanases for biopreparation of cotton, linen and hemp fabrics and their blends; the intensification of bioscouring with chelating agents; the evaluation of the degradation and removal of non-cellulosic matters, especially waxes and seed-coat fragments; the characterization of the dyeing and finishing properties of the biopretreated fabrics; the assessment of the environmental effect of the enzyme process, as well as the production of new microbial enzymes by solid-state fermentation for efficient biopreparation of cotton and linen substrates. In the field of biofinishing or biopolishing our main goals are to improve the softness, handle and comfort properties of linen fabrics, and to produce a fashionable whitish surface look and smooth handle of dyed cotton knitted fabrics. Our current research also includes the industrial application of biopreparation and biofinishing for cotton, cotton/linen and cotton/hemp knits on jet.

In this presentation examples of using different enzymes and technologies in the preparatory and finishing processing of cellulosic fibres will be reviewed. Results of the industrialized bioscouring and biofinishing processes will be explored and evaluated. The opportunities and directions for future research will also be summarized.

## References:

1. Csiszár, E., Szakács, Gy., Rusznák, I.: Combining Traditional Cotton Scouring with Cellulase Enzymatic Treatment, *Textile Research Journal* 68(3), 163-167 (1998).
2. Csiszár, E., Szakács, G., Rusznák, I.: Bioscouring of Cotton Fabrics with Cellulase Enzyme, In *Enzyme Applications for Fiber Processing*, K. Eriksson, A. Cavaco-Paulo, Eds.; ACS Symposium Series 687, Washington, D.C., 1998, pp 204-211

3. Csiszár, E., Urbánszki, K., Szakács, G.: Biotreatment of Desized Cotton Fabrics by Commercial Cellulase and Xylanase Enzymes, *Journal of Molecular Catalysis B: Enzymatic* 11, 1065-1072 (2001).
4. Csiszár, E., Losonczi, A., Szakács, G., Rusznák, I., Bezúr, L., Reicher, J.: Enzymes and Chelating Agent in Cotton Pretreatment, *Journal of Biotechnology*, 89, 271-279 (2001).
5. Losonczi, A., Csiszár, E., Szakács, G., Kareela, O.: Bleachability and Dyeing Properties of Biopretreated and Conventionally Scoured Cotton Fabrics, *Textile Research Journal*, 74(6), 501-508 (2004).
6. Csiszár, E., Losonczi, A., Szakács, G., Bezúr, L., Kustos, K.: Influence of EDTA Complexing Agent on Biopreparation of Linen Fabric, *Biocat. & Biotransform.* Vol. 22 (5/6) 369-374 (2004)
7. Csiszár, E., Somlai, P.: Improving Softness and Hand of Linen and Linen-Containing Fabrics with Finishing, *AATCC Review*, Vol. 4, No. 3. March, 17-21 (2004)
8. Losonczi, A., Csiszár, E., Szakács, G., Bezúr, L.: Role of the EDTA Chelating Agent in Bioscouring of Cotton, *Textile Research Journal* 75(5), 411-417 (2005).
9. Csiszár, E., Losonczi, A., Koczka, B., Szakács, G., Pomlényi, A.: Degradation of Lignin-containing Materials by Xylanase in Biopreparation of Cotton, *Biotechnology Letters*, 28(10), 749-753 (2006).
10. Csiszár, E., Szakacs, G., Koczka, B.: Biopreparation of Cotton Fabrics with Enzymes Produced by Solid-state Fermentation, *Enzyme and Microbial Technology*, 40, 1765-1771 (2007).