Shrinkproofing of Wool Fabrics by Pulse Corona Discharge and Enzymes

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Abstract

In this article modification of wool fibers and fabrics by pulse corona discharge and enzymes, in particular purified keratinase with a single component has been carried out to improve their surface properties. The shrinkproofing, tensile strength, weight loss, and the primary hand values calculated from the mechanical properties of the dual treated wool fabrics were investigated. In addition, the surface morphology of wool fiber was observed under the dry and wet conditions using an environmental SEM, ESEM.

Introduction

The use of enzymes begins in the textile processing from the viewpoint of ecology. However it was found that shrinkproofing of wool fabrics is difficult to be achieved by enzyme treatment alone. It was already shown that shrinkproofing is obtained considerably by combined low temperature plasma/enzyme treatment. In this article modification of wool fibers and fabrics by the pulse corona discharge and enzymes has been made.

Experimental

The process in this experiment was as follows: Wool fabrics were treated by the pulse corona discharge and enzymes. After the treatment area shrinkage, yarn tensile strength, weight loss, hand values, and surface properties were investigated. The pulse corona discharge was carried out under the conditions of atmospheric pressure in air. It caused the surface of fabrics hydrophilic without generation of heat [1].

The enzymes used in this experiment were Biosoak K, Keratinase II, and its monocomponent (Daiwa Chemical Co.). These were obtained from *Nocardiopsis sp.* and classified as a keratinase. The enzyme treatment was carried out at pH 9 and 50℃ in the bath ratio of 1:20. The treating times and enzyme concentrations were changed. Shrinkage test was carried out according to the IWS TM185 method.

Results

The relation between area shrinkage and treatment time or concentration of enzyme for Biosoak K, Keratinase II, and Keratinase II-monocomponent was investigated. The area shrinkage decreased with increasing the concentration and treatment time of enzyme. The enzyme treatment after the pulse corona discharge was very effective compared to the enzyme treatment alone.

The strength decreased with increasing the enzyme concentration and treatment time. The strength decreased with decreasing the area shrinkage. The pulse corona pretreatment suppressed the decrease of strength significantly. The most efficient enzyme for shrinkproofing was Keratinase II-monocomponent. In this case the decrease of strength was less than 10% relative to the original fibers when the 5% of area shrinkage was attained. The weight loss increased with decreasing the area shrinkage. Also in this case the weight loss was suppressed significantly by the pretreatment of pulse corona.

The primary hand value of Koshi (stiffness), Shari (crispness), Fukurami (fullness and softness), and Hari (spread, anti-drape) of the wool fabrics were not changed after the dual treatment compared with those of the untreated fabrics.

From the SEM pictures, the single treatment of enzyme caused very large and uneven damages compared to the combined treatment. Pulse corona/enzyme treated wool fiber was almost even and less damaged. The scales were comparatively smooth under the wet condition. The pretreatment of pulse corona discharge causes to change the wool surface more hydrophilic like low temperature plasma treatment [1]. Consequently the treated wool fibers are subject to uniform change by the subsequent enzyme treatment.

References

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