Photo-reactive Coloration of Wool Fabrics by UV irradiation

Yuanyuan Dong and Jinho Jang

Department of Nano-Bio Textile Engineering, Kumoh National Institute of Technology,
1 Yangho-dong, Gumi-si, Gyeongsangbuk-do, 730-701, Korea
E-mail: jh.jang@kumoh.ac.kr

1. INTRODUCTION

Wool fabrics can be dyed by acid, metal-complex, mordant and reactive dyes. In the reactive dyeing of wool fibers of a relatively low surface free energy, the dyeing temperature usually very high and alkalis are not used to induce the reaction between wool and reactive dyes due to severe alkaline degradation of the wool, which can be achieved by an increase in temperature.

Surface modification can impart beneficial improvement in the dyeability to wool. The dry methods for modifying the wool surface such as plasma, corona discharge or UV/ozone treatment have been investigated and these methods can lower dyeing temperatures and fasten dyeing rate in comparison to conventional dyeing.

Grafting is known to be useful for the introduction of various functional groups into polymeric materials by selecting a suitable monomer of functionality.

UV-induced surface graft polymerization has been widely applied to the surface modification of polymers as it is a simple, useful and versatile technique. In this study, the direct photografting of a vinylsulfone dye was carried out onto the wool fabrics by UV irradiation.

2. EXPERIMENTAL

2.1 Materials

Plain weave wool (98g/m^2) fabrics were used for study. A bisvinylsulfone reactive dye, supplied by DyStar Texilarben GmbH & Co., was used as a UV-active monomer for the coloration.

2.2 Photografting

Wool fabrics were immersed into the grafting formulation containing dye, photoinitiator and Triton X100. Then the wetted fabrics were squeezed to a wet pick up of about 90% using a padding mangle.

A UV apparatus enclosing a D-bulb of 80W/cm intensity was used for UV irradiation. After UV irradiation, the fabrics were thoroughly extracted first with 2% detergent solution at 60^{o}C for 30min and subsequently with running water to remove unreacted materials.

3. RESULTS AND DISCUSSION

Upon UV irradiation, the grafting yield and grafting efficiency of the grafted wool fabrics increased by increasing dye concentration and UV energy. Although the grafting of the monomer reached a maximum depending on dye concentrations, the color yield (K/S) did increase with the dye concentration. The variation of the graft yield and efficiency may be attributed to the gel formation of the dyes at large dye concentration which would increase the viscosity of the photografting medium and accordingly hinder the diffusion of dyes into the wool molecules.

Significantly, this continuous photografting of the dye is capable of operating at room temperature without neutral salts at a low liquor ratio of 1:1. In particular, the deep coloration was obtained and washing fastness was good and comparable to conventional reactive dyeing method.

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