Hydrophilic Modification of PET Fabrics via Photografting of Acrylic Acid

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1. Introduction

Poly(ethylene terephthalate) (PET) has excellent mechanical properties, outstanding stabilities, low cost and so on. But the hydrophobic property limited its application. In this study, acrylic acid was successfully grafted onto PET fabrics via UV irradiation. And its cationic dyeability increased remarkably. Effects of acrylic acid concentration, photoinitiator concentration, the amount of UV energy on the photografting have been studied. FTIR-ATR and FE-SEM were used to characterize the surface of PET.

2. Experimental

2.1. Material

Plain weave PET fabrics were obtained from Saehan Co. Ltd. Acrylic acid, Bis(2,4,6-trimethyl benzoyl)-phenylphosphineoxide, Triton X100 were used as a hydrophilic monomer, a photoinitiator, a wetting agent for grafting respectively. Cationic dyes of Rifa Cationic Blue GRL 300(C.I. Basic Blue 41) and Rifa Cationic Pink FG(C.I. Basic Red 13) were used for dyeing.

2.2. Photografting via UV irradiation

PET fabric was immersed into the grafting solution that contained acrylic acid, PI and Triton X100 to make the solution penetrated into the fabric well. Then the wetted fabric was padded to a WPU of about 50% using a squeeze mangle. A UVA CUBE which give a near UV light was used for the curing. Grafting yeild(G%) and grafting efficiency(GE%) were calculated as followings:

$$G\%=(W_3-W_1)/W_1\times 100\%$$

$$GE\%=(W_3-W_2)/(W_2-W_1)\times 100\%$$

Where W_1 is the weight of original fabric, W_2 is the weight of fabric after UV irradiation, W_3 is the weight of grafted fabric after washing with boiling water.

2.3. Cationic dyeing

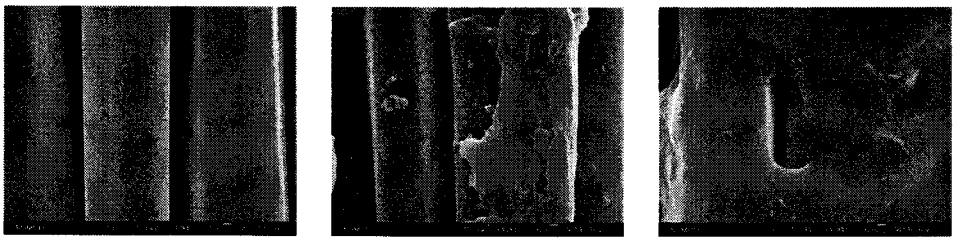
The grafted samples were dyed with the cationic red and blue dyes. The conditions for dyeing were as the following: liquor ratio of 50:1, dye concentration of 3%owf, pH 5.5, at 80°C for one hour. Dyeing was carried out in an IR dyeing testing machine.

2.4. Surface analysis and evaluation of dyeing

FTIR-ATR(FT-IR 300E, JASCO) and FE-SEM(JEOL JSM-6580F, Japan) were used to characterize the surfaces of untreated and grafted PET fabrics. A UV-VIS spectrophotometer(Kontron Instruments) was used for measuring the exhaustion based on the remaining dyeing liquor. Also reflectance and K/S were obtained with a reflectance spectrophotometer(Gretag Macbeth, Coloreye3100).

3. Results and discussion

Figure 1 shows the morphology of untreated and grafted PET fabrics. It can be seen that the fibers are covered by the grafted polyacrylic acid with increasing G%. Figure 2 and Figure 3 show the cationic dyeing results of untreated and grafted PET fabric. Increase in the grafting yield can increase cation dyeability. Both E% and K/S increased, indicating that PET fabric's cationic dyeability can be successfully improved by the photografting.



(a) (b) (c)

Figure 1. SEM image of untreated and grafted samples: (a) untreated; (b) 8.9%grafted; (c) 11.6%grafted

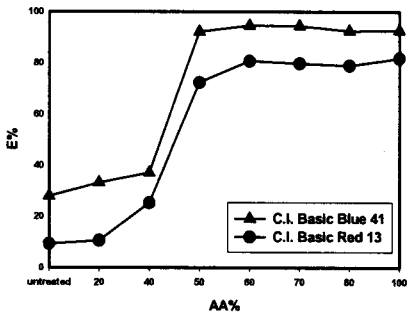


Figure 2. Exhaustion of dyed PET fabrics.

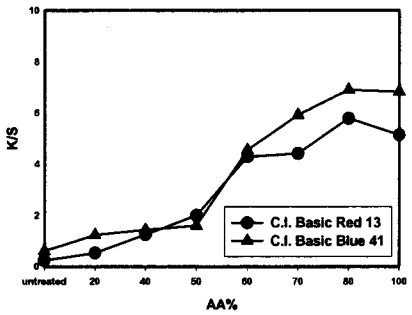


Figure 3. K/S of dyed PET fabrics.

4. Conclusion

PET fabric can be successfully modified by grafting of hydrophilic acrylic acid. The grafted PET fabrics showed higher dyeability to cationic dyes.

5. References

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