PEO_{45}-MeDMA를 이용한 m-aramid 섬유의 염색특성
Dyeing Properties of m-Aramid Fibers Using PEO_{45}-MeDMA

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Abstract

A diblock copolymer (PEO_{45}-MeDMA) derived from [2-(methacryloyloxy) ethyl] trimethylammonium chloride (MeDMA) was synthesized and applied to the meta-aramid fibers. Meta-aramid fabric was pretreated with PEO_{45}-MeDMA and successfully dyed with acid dyes. The dyeability of this fabric was investigated and found to depend on the PEO_{45}-MeDMA concentration, pH, and dye concentration. The color fastness properties of the copolymer pretreated dyed fabric was evaluated.

1. Introduction

Meta-linked aromatic polyamide fibers (aramid fibers) are made from high molecular weight polymers that are highly crystalline and have either high or no glass transition temperature. Therefore, dyeing aramid fibers are difficult.

In this study, the aramid fiber was pretreated with PEO_{45}-MeDMA diblock copolymer to provide dyesites capable of bonding with anionic dyes. The dyeing properties of meta-aramid fibers and fastness properties were investigated.

2. Experimental

2.1 PEO_{45}-MeDMA diblock copolymer synthesis

Anhydrous toluene (130ml) was added to a dry three-necked round-bottom flask, via a canulla followed by addition of polyethylene glycol (0.0105mol). Under a dry nitrogen atmosphere, 2-bromoisobutyryl bromide (0.01mol) was added dropwise through the addition funnel, and a solution of triethyl amine (0.01mol) in toluene (20ml) was added dropwise through a canulla. 5g of charcoal was added to the mixture and stirred for 1hr before being filtered directly into the reaction flask through a 0.45㎛ syringe filter. Sodium sulfate was added to the filtrated mixture for dehydration. PEO_{45}-Br (0.277g, 0.01mol) and MeDMA (8.3g, 0.3mol) codissolved

in water (6.2ml) were added to a dry three-necked round bottom flask. After purging with nitrogen for 30 min, the Cu(Ⅰ)Br catalyst (0.1mol) and by-ligand (2, 2'-bipyridine, 0.025mol) were added under nitrogen.

2.2 Dyeing Procedure

A solution of PEO_{45}-MeDMA copolymer added onto the meta-aramid fabric at 100% wet pick-up. The padded samples were dried and cured at 170℃ for 3 min.

The dyebath was prepared by adding dye and levelling agent. Acetic acid was added to control the pH. Pretreated and untreated fabrics were added to the dyebath, then the temperature was raised to 100℃and left for 60 min. All dyeing were carried out using a 1:20 liquor ratio. Wash fastness test was performed according to the ISO test method.

3. Results and Conclusion

3.1 Copolymer synthesis and characterization

The ethylene glycol residues of the PEO_{45}-Br were observed at 3.6 ppm. A new signal in the latter spectrum appeared at 3.1 ppm, which was assigned to the trimethyl tertiary amine signal of MeDMA.

3.2 Effect of the PEO45-MeDMA Diblock Copolymer Concentration

The K/S values of fabrics treated with 0.5% (w/w) of copolymer were markedly higher than those of the corresponding untreated fabrics.

3.3 Influence of pH in Dyebath

The color strength of meta-aramid fiber dyed with Acid Red 57 in pH 3 was higher than that of in pH 5. However, the color strength increased on dyeing with Acid Red Unknown at pH 5.

3.4 Effect of the Dye Concentration

The color strength of treated aramid fabrics increased for all the dyes in comparison with the untreated samples.

3.5 Fastness properties

Compared with the untreated aramid fiber, the treated ones have good fading and staining fastness.

References

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