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Surface Properties of the hydrazinolyzed Poly(ethylene terephthalate)/Nylon 6 Fibers

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Abstract

Microfibers of Poly(ethylene terephthalate)(PET)/Nylon 6 (P/N) was heat set at 170℃ in a fixed state and then treated with hydrazine at 30℃ for 5, 10, 15, 20, 30 and 40 h. Weight loss from the hydrazine treatment increased according to the hydrazine concentration(Fig.1). In order to investigate in detail the effect of the electrostatic attraction between the dye anion and hydrazide groups in cooperated by hydrazinolysis, ζ-potential of P/N fiber was measured by streaming potential method . The surface charge density, σ, of the fiber was evaluated from the ζ-potential.

Dye exhaustion with C. I. acid orange 7 showed trends similar to the weight loss of the hydrazinolyzed P/N fibers(Fig.2). On the other hand, the dyeability of the hydrazinolyzed P/N fiber with C. I. disperse blue 56 was the same of that of controled fibers. Many cracks appeared on the surface of the hydrazinolyzed fibers, and they were smallest on the controled fibers.

Introduction

Although Poly(ethylene Terephthalate)(PET)/Nylon 6 fibers are generally resistant to chemical attacks the ester linkage in the PET molecular chain can be severed by some chemicals such as alkalies and amines, In practice, hydrolysis of PET fiber with aqueous NaOH solution has been applied to the soft and hydrophilic finishes of the fabric. Aminolysis has been studied in relation to surface charged density and dyeability of P/N fibers.

In the article, in order to investigate the effect of the concentration of hydrazine on the hydrazinolysis of P/N fibers, which have a fine structure different from regular synthetic fibers, we subjected the hydrazided P/N fibers to ζ-potential and dyeability.

Experimental

The Poly(ethylene Terephthalate)/Nylon 6 (P/N)fibers were 150 denier and 72 filaments(Koron Ltd. Co.). The sample was wound on as aluminum frame and heat set at 170℃ for 10 minutes. The heat-set sample were cleaned with toluene, acetone and distilled water, and then dried in a desiccator oven P_2O_5 for a week.

Hydrazinolysis was done in 10%, 20% and 30% aqueous monohydroxide hydrazine at 30℃ for 5, 10, 15, 20, 30 and 40 hours in shaking bath, and the final wash was done with distilled water. Weight loss from the hydrazinolysis was determined using gravimetric measurements.

Acid dyeing was done in 3% o.w.f. aqueous C.I. Acid Orange 7 solution at 80℃ for 120 hours in a shaking bath. The absorbed dye was extracted with 25% pyridine solution and determined colorimetrically.

Disperse dyeing was done in 0.6g/l aqueous C.I. disperse Blue 56 solution at 120℃ for 5 hours, the adsorbed dye was extracted with monochloro benzen and determined colorimetrically.

The ζ-potential was measured by the method of the streaming potential and was calculated by means of the Helmholtz-Smoluchowski equation.

$$\zeta = H/P \cdot 4\pi\eta/D$$

Sodium chloride was added to the solution in order to prevent any influence of the ionic strength on the ζ-potential its concentration was 10^{-4}mol/l.

From the volume of the ζ-potential obtained, the surface charged density which was derived from Boltzmann's distribution law and from Gouy's theory.

$$\sigma = \pm (kTD/2\pi)^{1/2}[\Sigma nj\{\exp(-ej\zeta/kT)-1\}]^{1/2}$$

Where k : Boltzmann constant, T : absolute temperature, D: dielectric constant, nj : number of j-cations or anions per unit of volume in the bulk solution, ej = Zje. e : electronic charge, Zj : valency of the j-cation or anion.

Results and Discussion

Weight loss of the hydrazinolyzed fibers are shown in Fig. 1. Weight loss continuously decreased with increased concentration of hydrazine.
Dye exhaustions of the hydrazinolyzed P/N fibers for 5, 10, 15, 20, 30 and 40 are shown in Fig. 2. Dye exhaustion for the concentration of the hydrazine continuously increased.

The ζ-potential for the fiber in solutions of hydrochloric acid or sodium hydroxide invarious concentrations was measured in order to ascertain the influence of the pH on ζ. The results are shown in Fig. 3. The results of the influence of the pH and σ are shown Fig.4.

The ζ-potential of any fiber is positive in an acidic solution and negative in an alkaline one. From these results it was found that treated fiber decreased in an alkaline solution by attached amine groups.

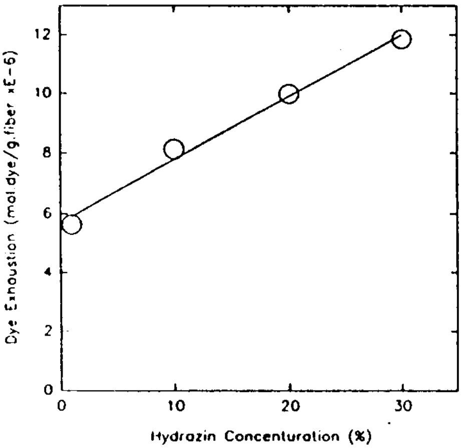

Fig2 Effect of the concenturation of hydrazine on the acid dye exhaustion

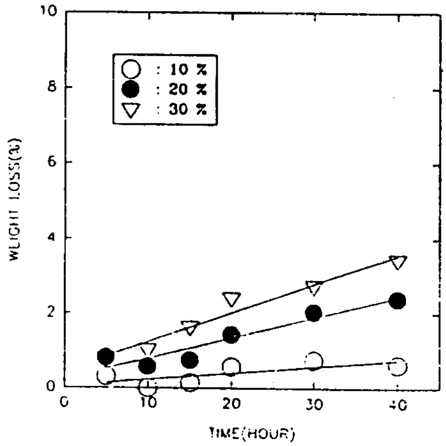

Fig1. Effect of the treated time on the weight loss of P/N fibers treated with hydrazine

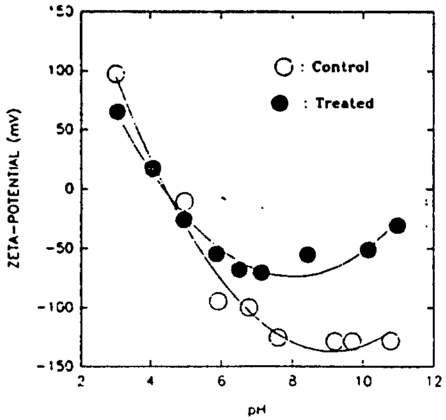

Fig3. Influence of pH on Zeta-Potential of controled and hydrizine treated N/P fibers at 30℃

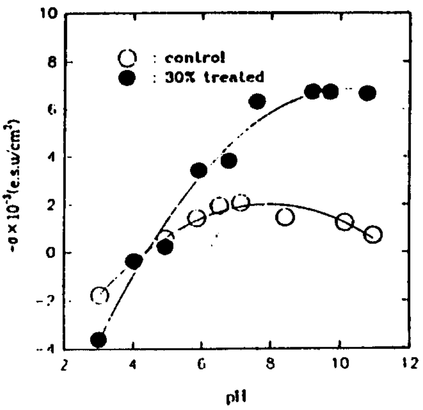

Fig 4 Influence of pH on surface charge density of controled and treated fibers at 30 ℃

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