SURFACE MODIFICATION OF POLYESTER USING CHICKEN FEATHER KERATIN HYDROLYSATE TO IMPROVE WATER ABSORBENCY AND DYE UPTAKE

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ABSTRACT

PET fiber has an intrinsic low hydrophilic character and an inactive surface which make it uncomfortable for wearing purpose. Moreover, it is difficult to colour polyester fabric other than disperse dyes. Therefore, surface modification of PET is very important to improve its absorbency and bring the possibility to dye polyester with anionic dyes by altering its surface characteristics. This research was focused on surface modification of polyester using chicken feather which involves serine as the most abundant amino acid with hydroxyl groups. The treated polyester fabric using 20ml/L concentration of chicken feather extract showed improved water drop absorbency from 45 into 3 seconds and the reactive dye uptake by 36 folds from 0.15 to 5.37 K/S values.

KeyWords: PET; CHICKEN FEATHER; SURFACE MODIFICATION; KERATIN HYDROLYSATE

1. INTRODUCTION

Polyester fabric is widely used due to its strength and resistance to chemicals. However, the low hydrophilic character and inactive surface of PET fabric make it difficult to dye using anionic dyes rather. Modified polyester fibers are thus prepared to overcome the drawbacks like moisture regain, static electricity and soiling problems. The drawbacks are interrelated and associated with the hydrophobicity of the polyester [1]. The conventional modification of PET fiber properties was through strong alkali treatment under high processing temperature which causes higher fiber degradation. On the other hand, an estimated 15 million tone of chicken feathers disposed each year globally by meat manufacturers [2]. Currently, the feathers are disposed of in landfill, burned or processed to make a low-grade animal feedstock

astes for textile application has a dual benefit in modifying the surface structure of PET and minimizing the environmental impact of the feather wastes. The surface modification of textile fibers with bio-products has been considering as the best route to obtain modern textile treatments [4]. It enables the required level of beneficial effect by the modification of fiber surface only, thus minimizing whole fiber attack, and hence the deterioration in fiber quality could be easily avoided. In the present work, surface modification of PET has been carried out using dissolved chicken feather keratin hydrolysate and a satisfactory result was achieved.

2. METHODOLOGY

2.1. Materials and Chemicals

Woven PET fabric [150] GSM was used and a chicken feather (Figure 1) was collected from Kombolcha, Ethiopia. Sodium hydro oxide (NaOH) to dissolve Chicken Feather and reactive dye for dyeing was employed.

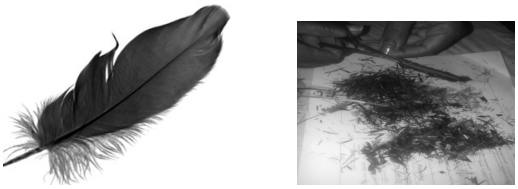

Figure 1. Chicken feather (left), choped chicken feather (right)

2.2. Experiments

The feather was washed to remove foreign matters, chopped into smaller pieces (Figure 1) and dissolved under 20 g/L NaOH aqueous solution at room temperature for 15 minutes. The chicken feather to liquor ration (MLR) was 1:10. Then, 5 to 25 ml/L chicken feather extract (keratin hydrolysate) were applied on PET fabric by the exaust method at 70^{o}C for 60 minutes at 1:20 MLR. Drying was carried out at 100^{o}C for 4 minutes. The surface modified PET fabric was subjected to Dichlorotrazine reactive dyeing at 60 ^{o}C for 60 minutes under MLR of 1:20.

2.3. Evaluation methods

The improvement in absorbency was determined by drop test based on AATCC Test Method 79. The wash and crock fastness of the reactive dyed fabric were tested using ISO Test Method 105(C1S) and AATCC Test Method 8 respectively. Colour Eye 1500 was used to measure the K/S values of dyed samples.

RESULT AND DISCUSION

The Untreated PET fabric (Figure 3: A and B) result showed very strong resistance to water absorbency and reactive dye uptake. The time recorded for the water drop complete absorption was 45 seconds. The untreated PET fabric did not get colored with reactive dyes. This proved that the fabric was impossible to dye using anionic dyes. Besides, having less water absorbency makes PET fabric unsuitable and uncomfortable for wearing purpose.

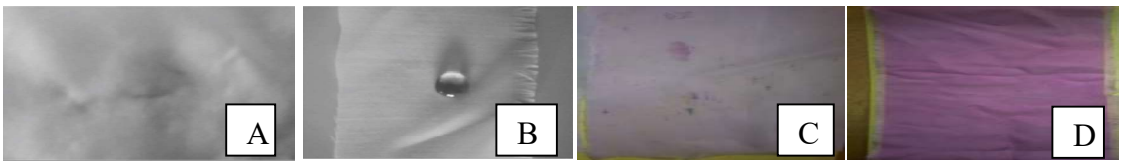

Figure 3. Drop absorbency test: Untreated (A) and Treated (B) and dyeing: Untreated (C) and Treated (D)

On therhand, the chicken feather treated PET fabric (Figure 4: C and D) results showed excellent absorbency and dye uptake. The water droplet was absorped compeletely within 3 seconds and 5.37 K/S value after dyeing with reactive dye were observed when 20ml/L chicken feather extract was applied.

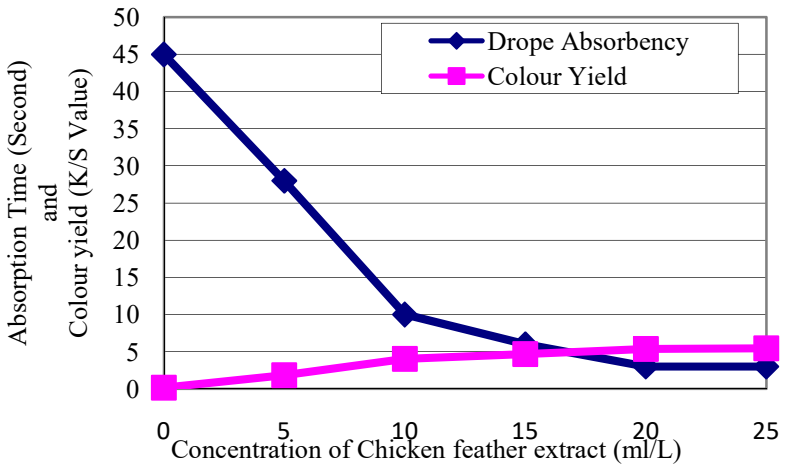

Figure 4. Absorbency and reactive dye up take of PET fabric

The graph (Figure 4) shows that time of drop absorbency was reduce by 15 folds and dye up take was increased by 36.26 folds

Table 4. Washing and crock fasteness of PET fabric treated with dissolved feather

Wash		Crock			
Color change	stain	Dry		Wet	
		Color change	Stain	Color change	stain
4/5	4-/	4/5	4/5	4	4

The washing and crock fastness results (Table 4) of the surface modified and reactive dyed PET were obtaied very good.

3. REFERENCES

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