가교결합에 사용되는 촉매의 새로운 평가법

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A Novel Evaluation on Catalysts for Crosslinking Agent

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1. Introduction

Silk is one of the most desirable textile materials because of its excellent properties such as handle or luster that distinguish them from other fibers. However, it has some minor textile performances such as crease recovery, dimensional stability, rubbing reisistance, photo-yellowing stability, *etc* [1]. So, the crosslinking of silk fabrics has been widely researched to improve their some properties. It is well known that not only 1,2,3,4--butanetetracarboxlyic acid (BTCA) but also citric acid (CIT) can be applied as a crosslinking agent as well as CIT has a price competition compared with BTCA. In general, these multi-carboxylic acid has been introduced as the alternative candidate of formaldehyde containing durable press (DP) finishing agents such as dimethyloldihydroxy ethylenurea (DMDHEU), the most popular finishing agent. In our previous study, we carefully proposed that the correlation analysis between dTGA peak point temperature (dTPT) and add-on value(%) (AOV) of the crosslinked silk fabrics had some potential to evaluate the catalysts for crosslinking agent, BTCA. In this study, it has been examined the feasibility of novel evaluation method on some catalysts for the crosslinking agent, CIT .

2. Experimental

2.1. Materials

Silk fabrics (KS K 0905) were purchased from Korea Apparel Testing & Research Institute (KATRI). BTCA, sodium acetate (SA), sodium propionate (SP), sodium butyrate (SB), and sodium hypophosphite (SH) for crosslink of silk fabrics and sodium carbonate, sodium bicarbonate, and triton X-100 for degumming were supplied from Aldrich Co. and Junsei Co., respectively.

2.2. Degummung and Crosslinking of silk fabrics

Silk fabrics were degummed with sodium carbonate (1.06% w/w), sodium bicarbonate (0.84% w/w), and triton X-100 (0.30% w/w) solution (Liquor ratio=1:40) at 100℃ for 2 hours and washed thoroughly with distilled water. The degummed silk fabrics were crosslinked by the pad-dry-cure (PDC) method. The aqueous padding solution consisted of 60g/l of crosslinking agent and 0.25mol of catalysts. The degummed silk fabrics were padded using a laboratory padder and wet pickup was 120%. Pre-drying temperature and time were 60℃ and 5 min, respectively. The curing

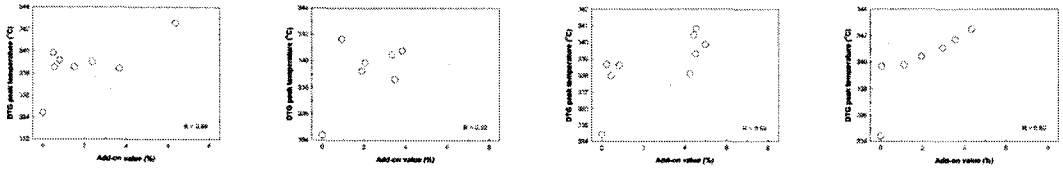
temperature and time were 120-160℃ and 3-5 min respectively. The cured silk fabrics were washed with distilled water at 50℃ for 30 min and then dried.

2.3. Analysis

Weight gains of the modified silk fabrics were calculated on the basis of the weight of oven-dried silk fabrics before and after the PDC procedure. Dry crease recovery angles of the cured silk fabrics were measured with automatic crease recovery tester ACM-7P, Daiei Kagaku Seiki Mfg. Co., Ltd. for 10 min (n=7). TGA analysis was performed in nitrogen (gas flow rate of 60ml/min) on TGA Q-500, TA Instruments at a heating rate of 20℃/min.

3. Results and discussion

SH is widely used as an effective catalyst for the esterification reaction of silk. But their commercial applications as catalyst in textile processing are limited because their reductive nature and the effluents containing phosphorus cause eutrophication in rivers and lakes [2]. So, it is very simple to understand that it has to be found an alternative of multi-carboxylic acids. It is well known that the thermal stability of the crosslinked silk fabrics with the multi-carboxylic acid was increased with increasement of AOV [3,4]. As seen in Fig. 1, the correlation coefficient was 0.69, 0.52, 0.69, and 0.80 for CIT-SA, CIT-SB, CIT-SH, and CIT-SP, respectively, indicating that SA and SP could be the alternative of SH. Therefore, it could be speculated that the correlation analysis between dTPT and AOV had some possibility to be applied to evaluate catalysts for crosslinking agents.



(a) (b) (c) (d)

Fig. 1. The correlation analysis between dTPT and AOV of the crosslinked silk fabrics with some catalysts such as (a) SA; (b) SB; (c) CH; (d) SP.

4. Conclusion

By correlation analysis between dTPT and AOV of the crosslinked silk fabrics with some catalysts, it was inferred that SA and SP could be the alternative of SH. Consequently, we propose that this novel evaluation method have some great feasibility to appraise catalysts for crosslinking agnts.

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