Eco-benign Pre-treatment Technology on DTP by In-line Atmospheric Plasma

Choe Jongdeok, Kim Sideuk, Park Beop, Koo Kang, Park Youngmi[1,*]

School of Textiles, Yeungnam University, [1]Research Institute of Clothing & Textile Science, Yonsei University

1. Introduction

Appropriate atmospheric plasma (AP) treatment is widely employed to modify the surface property of the polymers. The physicochemical surface properties, following as etching, grafting, polymerization and cross-linking, can be obtained through the treatment of environmental-friendly dry process, without altering the polymer inner property. Digital Textile Printing (DTP) regarded as the very efficient textile printing system which contains computing process from pattern design to printing. Main product of a DTP technology is consisted of software, printer, ink and treated printing media. In order to obtain good result from DTP finishing, the fabric need to treat with pre-treatment before digital printing. In this study, the possibility of using of the AP treatment instead of the usual media treatment was studied.

2. Experimental

AP treated into fabrics with voltage of 0.2, 0.5 and 1kW, repeating 1, 3, 5 times. The DTP-exclusive cotton, control and the AP treated cotton were DTP printed with CMR Reactive Ink, and then investigated contact angle by goniometer (OCA 20, Data Physics Instrucments Ltd., Germany), half value time by Static Honestmeter (Shishido Electrostatic Ltd., Japan), absorption height by KS K 9073-6 methods, surface morphology by FE-SEM (S-4100, Hitachi Co. Ltd., Japan), K/S by CCM (X-Rite 8200, X-Rite Co., USA), sharpness by real-image microscope (Dr.Camscope, Miki international Co. Ltd.,), wash fastness by KS K 0430(A-1) and colorfastness to rubbing by KS K 0650 methods.

3. Results and discussion

To develop of DTP finishing, the fabric treated with pre-treatment before digital printing. The possibility of using of the AP treatment instead of the usual media treatment was investigated.

The results are as follows: 1. Represented contact angle of each 85˚, 80˚ at wave and untreated PET textile and film decreased by 24˚, 40˚, after AP treatment, handle 3 times and voltage of 1kW, resulting in wettability increases because surface is reformed by hydrophilic property by AP. 2. Confirmed that half time is shorted by wave and AP treatment which measure half-time by generation voltage radical. 3. Absorption height of untreated sample and AP treated sample confirmed that difference is exposure to 7mm (1kW, 3th treatment) and absorptiveness increased by AP in case of absorptiveness results of measurements for cotton fabrics. In PET textile, absorption height's difference great as absorption height's difference was expose to 6mm (1 kW, 3th treatment) and measurement time increases. 4. No physical change by SEM observed clearly. 5. The color development, sharpness and fastness were improved by AP treatment. 6. Surface modification effect by ASurfesented good effect as treatment voltage urfesime increased. Displayed excellent performurce as treatment freqeancy increases at voltage ange 5 kw in efficiancy test after printing. 7. When untreated free medical care, AP treatment, chemical agents treatment 3 sample of existing did comparative analysis, performance has dropped a little than chemical agents treatment as for study finding but was confirmed that principal parts possibility of chemical agents treatment is because is displaying more superior effect than untreated sample. 8. The colorfastness of wash and rubbing in digital printed cotton fabrics were resulted in Table 1.

Table 1. Colorfastness to washing and rubbing of digital printed cotton fabrics.

Fastness to gray scales	Grades			
	Cyan	Red	Yellow	Black
Washing color change	3-4	3-4	3-4	3-4
Rubbing staining at dry	3-4	3-4	3-4	3-4

4. Conclusion

During the DTP pretreatment, the AP process was introduced with diverse conditions and then the surface change and dyeing properties after printing were discussed. In summary, as increase of voltage, the contact angle decreased caused by hydrophlic modification of fabric surface. Half time, of course, shortened by AP. The difference of water absorption in cotton and PET were confirmed by height of 7mm and 6mm, respectively, compared to control. SEM could not verified the morphological change clearly. After the AP treatment, K/S, acutance and colorfastness of wash and rubbing were developed than control. From analysis the control, AP treated sample and chemical treated sample, AP treated ones were lower performance than chemically treated, while more effective than control, so, AP process expected alternatives chemical treatment.