[Transaction]

Journal of the Korean Society
of Clothing and Textiles
Vol. 30, No. 12 (2006) p.1683~1689

The Appearance-related Properties and the Mechanical Properties of Lyocell-interlining Bonded Fabric

In Young Kim · Wha Soon Song†

Dept. of Clothing & Textiles, Sookmyung Women's University

리오셀직물 심지접착포의 외관적 성능과 역학적 특성

김인영 · 송화순†

숙명여자대학교 생활과학부 의류학전공

(2006. 6. 21. 접수)

Abstract

Precedent researches on lyocell are mostly on lyocell structure, characteristics, physical properties by finishing and dyeability, and the like; there are little cases of researches on interlining for lyocell clothes production. To serve as a base information helpful to select fusible interlining and improve the efficiency of sewing process considering the characteristics of lyocell, this study performed t-test, F-test toward to the difference in the appearance-related properties and the mechanical properties of lyocell-interlining bonded fabric in accordance with the characteristics of fusible interlining and lyocell face fabric. This study reached following conclusions. Drapability and Crease recovery of lyocell-interlining bonded fabric are influenced by the structure of fusible interlining.; stiffness of lyocell-interlining bonded fabric, by the structure of fusible interlining and the yarn number of lyocell face fabric. WT is influenced by the mixture rate and yarn number of lyocell face fabric. RT is influenced by the yarn number of lyocell face fabric; G, 2HG, 2HG5, by the structure(woven and non-woven) of fusible interlining; B, HB, by the weight, structure(woven and non-woven) of fusible interlining, and yarn number of lyocell face fabric; WC, by the weight, structure of fusible interlining; RC, by the structure of fusible interlining; thickness, by the weight of fusible interlining and the yarn number of lyocell face fabric; weight, by mixture rate and yarn number of lyocell face fabric.

Key words: Lyocell, Fusible interlining, Lyocell-interlining bonded fabric, Appearance-related properties, Mechanical properties; 리오셀, 접착심지, 리오셀직물 심지접착포, 외관적 성능, 역학적 특성

I. Introduction

Recently, the demand for new material 'Lyocell' fabric which is widely used as apparel material is increasing because of its excellent mechanical properties such as wet strength, shape retention, soft handle. Precedent researches on lyocell are mostly on lyocell structure, characteristics, physical properties by finishing and dyeability, and the like(Jeong, 1996; Kim et al., 1999); there are little cases of researches on interlining for lyocell clothes production(Kim & Song, 2001; Kim et al., 2003). There are many cases when a bonding of interlining renders unexpected changes of handle, which are estimated to come from the lack of understanding of properties of the fusible interlining, lyocell face fabric and lyocell-interlining bonded fabric. Therefore, for production and quality control of clothing products, the study on this field is

†Corresponding author
E-mail: duccubi@sookmyung.ac.kr

required, which is by all means an important milestone that must precede any production of those kinds. Hereupon, the author, in his previous work (Kim & Song, 2001; Kim et al., 2003), has reported difference in appearance-related performances, shearing property, and bending property, subject to proper bonding conditions for bonding fusible interlining of lyocell.

In this study, the author performed t-test, F-test toward to the difference in the appearance-related properties and the mechanical properties of lyocell-interlining bonded fabric in accordance with the characteristics of fusible interlining and lyocell face fabric. Then the author analysed the result of t-test and f-test and showed upgraded data from previous work. This work will contribute to make database helpful to select fusible interlining and improve the efficiency of sewing process considering the characteristics of lyocell.

II. Specimen and Test Methods

1. Specimen

The lyocell face fabrics are obtained from Tongkook(Co.). The fusible interlinings are from Ilshin (Co.) & Korea Vilene(Co.). The characteristics are as listed in <Table 1, 2>.

2. Test methods

Lyocell-interlining bonded fabric was combined by making combinations of six kinds of fusible interlining and four kinds of lyocell face fabric, a total of 24 specimen were made. In bonding the fusible interlining and lyocell face fabric, a roller press machine (Korea Fibron, H-700d) was used, where the bonding conditions of the bonded fabric was at 120 under 3kgf/cm^2 pressure for 15 seconds(Kim & Song, 2001; Kim et al., 2003)

Appearance-related properties such as drapability, stiffness and crease recovery were measured. Drapability was evaluated according to KS K 0815. Stiffness was evaluated according to KS K 0539. Crease recovery was evaluated according to KS K 0550. Six items of mechanical properties such as tensile property, sharing property, bending property, compressive property, thickness and weight were measured using Kawabata Evaluation System for Fabrics(Kato, Tech., Co., Ltd).

Concerning the appearance-related properties and the mechanical properties of bonded fabric, F-tests were performed for significant difference varying the weight(34, 51, and 63 g/m^2) and structure(plain weave, twill weave, and non-woven fabric) of fusible interlining. t-tests were performed for significant differ-

Table 1. Characteristics of lyocell face fabrics

Fabric(%)	Yarn no. (Ne)	Fabric counts (ends*picks/5cm)	Weight (g/m^2)	Thickness (mm)	Weave
Tencel 100	20*20	110*74	222.5	0.36	Twill
Tencel 100	10*10	74*52	298.2	0.62	Twill
Tencel/Cotton 65/35	20*20	100*60	188.2	0.38	Twill
Tencel/Cotton 65/35	10*10	64*44	254.3	0.52	Twill

Table 2. Charateristics of interlinings

Fiber	Adhesive	Yarn no. (denier)	Fabric counts (ends*picks/5cm)	Weight(g/m^2)		Thickness (mm)	Structure
				Fabric	Adhesive		
PET	PA	50*75	58*48	34	11	0.34	Broken twill
PET	PA	50*150	59*38	51	11	0.36	Broken twill
PET	PA	50*300	59*29	63	11	0.45	Broken twill
PET	PA	50*50	63*52	30	8	0.24	Broken twill
PET	PA	50*50	63*52	30	8	0.22	Plain
PET	PA	-	-	30	8	0.22	Nonwoven

Table 3. The appearance-related properties of lyocell-interlining bonded fabric by the weight of interlining

Appearance-related properties	Weight of interlinings(g/m^2)						F-value	Dunkan grouping
	34		51		63			
	Mean	Std	Mean	Std	Mean	Std		
Drapability(%)	98.135	4.589	102.219	4.368	103.539	4.445	1.59	A A A
Stiffness(cm)	0.411	0.097	0.473	0.093	0.572	0.135	2.18	A A A
Crease recovery(%)	30.907	4.982	31.478	5.049	33.709	5.148	1.07	A A A

*α<0.10, **α<0.05, ***α<0.01

Table 4. The appearance-related properties of lyocell-interlining bonded fabric by the structure of interlining

Appearance-related properties	Structure of interlinings						F-value	Dunkan grouping
	Plain weave		Twill weave		Nonwoven			
	Mean	Std	Mean	Std	Mean	Std		
Drapability(%)	94.665	5.098	92.827	4.515	108.463	3.184	15.50***	B B A
Stiffness(cm)	0.352	0.086	0.315	0.083	0.619	0.134	10.21***	B B A
Crease recovery(%)	70.416	5.092	29.280	5.338	30.107	5.699	5.09**	A AB B

*α<0.10, **α<0.05, ***α<0.01

Table 5. The appearance-related properties of lyocell-interlining bonded fabric by the mixture rate of lyocell face fabric

Appearance-related properties	Face fabrics of 20's				t-value	Face fabrics of 10's				t-value
	Tencel 100		Tencel/Cotton 65/35			Tencel 100		Tencel/Cotton 65/35		
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	Mean	Std Dev	
Drapability(%)	96.029	6.314	101.766	6.765	-1.518	97.254	6.221	104.851	4.851	0.040**
Stiffness(cm)	0.344	0.089	0.411	0.125	-1.061	0.491	0.130	0.582	0.145	0.280
Crease recovery(%)	72.036	3.542	61.296	5.445	4.049***	72.407	6.140	66.666	6.133	1.620

*α<0.10, **α<0.05, ***α<0.01

ence varying the yarn number(20's and 10's) and mixture rate(Tencel 100, Tencel/cotton 65/35) of lyocell face fabric. SAS package program(v6.12) was used for the statistical analysis.

III. Results and Discussion

1. Appearance-related properties

The F-test results of difference in the appearance-related properties of lyocell-interlining bonded fabric, subject to the variation of characteristics of fusible interlining, were listed in <Table 3, 4>, and the t-test results of difference in appearance-related properties of lyocell-interlining bonded fabric, subject to the variation of characteristics of lyocell face fabric, were listed in <Table 5, 6>.

As shown in <Table 3>, as the result of F-test for difference in the appearance-related properties of lyocell-interlining bonded fabric, subject to the variation of fusible interlining weight, there were no significant difference in drapability, stiffness, and crease recovery. <Table 4>, the results of the F-test for difference in appearance-related properties of lyocell-interlining bonded fabric, subject to the variation of structure(plain weave, twill weave, and non-woven) of fusible interlining showed significant difference in drapability, stiffness, and crease recovery. As the result of Dunkan grouping, there was no acceptable significant difference between plain and twill inter-

ling. There was significant difference between woven and non-woven interlining.

As shown in <Table 5>, the result of t-test for difference in appearance-related properties of lyocell-interlining bonded fabric, subject to the variation of mixture rate of lyocell face fabric, there were no significant difference in drapability, stiffness, and crease recovery. <Table 6>, the result of t-test for difference in the appearance-related properties of lyocell-interlining bonded fabric, subject to the variation of lyocell face fabric yarn number(20's and 10's), showed significant difference in stiffness.

By putting the results altogether and analyzing, Drapability and crease recovery of lyocell-interlining bonded fabric are influenced by the structure of fusible interlining. They are excellent in the case of woven fusible interlining. Stiffness of lyocell-interlining bonded fabricis is influenced by the structure of fusible interlining and the yarn number of lyocell face fabric. It is increased in the case of non-woven fusible interlining and lyocell facefabric 10's.

2. Mechanical properties

The F-test results of difference in mechanical properties of lyocell-interlining bonded fabric, subject to the variation of characteristics of fusible interlining, shown in <Table 7, 8>, and the t-test results of

Table 6. The appearance-related properties of lyocell-interlining bonded fabric by the yarn number of lyocell face fabric

Appearance-related properties	Tencel 100				t-value	Tencel/Cotton 65/35				t-value
	20's		10's			20's		10's		
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	Mean	Std Dev	
Drapability(%)	96.029	6.314	97.254	6.221	-0.338	101.766	6.765	104.851	4.851	0.385
Stiffness(cm)	0.344	0.089	0.491	0.130	-2.271**	0.411	0.125	0.582	0.145	0.054*
Crease recovery(%)	72.036	3.542	72.407	6.140	-12.80	61.296	5.445	66.666	6.133	-1.603

*α<0.10, **α<0.05, ***α<0.010

Table 7. The mechanical properties of lyocell-interlining bonded fabric by the weight of interlining

The mechanical properties	Symbols	Weight of interlinings(g/m^2)						F-value	Dunkan grouping
		34		51		63			
		Mean	Std	Mean	Std	Mean	Std		
Tensile	LT	0.347	0.018	0.362	0.033	0.363	0.021	0.53	
	WT	5.771	1.000	6.296	1.575	6.116	0.788	0.21	
	RT	55.225	6.259	51.650	9.247	53.725	8.707	0.19	
	EMT	6.526	0.778	6.927	1.085	6.785	0.511	0.24	
Shear	G	1.988	0.497	1.933	0.460	2.307	0.549	0.64	
	2HG	2.963	0.949	3.193	0.779	3.652	0.649	0.76	
	2HG5	5.857	1.600	5.977	1.665	6.617	4.585	0.26	
Bending	B	0.434	0.115	0.511	0.109	0.684	0.139	4:41**	B AB A
	2HB	0.186	0.056	0.213	0.059	0.289	0.061	3.29**	B AB A
Compression	LC	0.450	0.021	0.439	0.030	0.462	0.024	0.87	
	WC	0.267	0.006	0.290	0.023	0.311	0.026	4.48**	B AB A
	RC	53.250	5.041	54.200	2.538	49.787	3.591	1.45	
Thickness	T	0.612	0.072	0.675	0.075	0.740	0.069	3.09*	B AB A
Weight	W	30.907	4.982	31.478	5.049	33.709	5.148	0.34	

*α<0.10, **α<0.05, ***α<0.01

difference in mechanical properties of lyocell-interlining bonded fabric, subject to the variation of characteristics of lyocell face fabric, shown in <Table 9, 10>.

As shown in <Table 7>, as a result of F-test for difference in mechanical properties of lyocell-interlining bonded fabric, subject to weight variation of

Table 8. The mechanical properties of lyocell-interlining bonded fabric by the structure of interlining

The mechanical properties	Sym-bols	Structure of interlinings						F-value	Dunkan grouping
		Plain		Twill		Nonwoven			
		Mean	Std	Mean	Std	Mean	Std		
Tensile	LT	0.347	0.016	0.352	0.021	0.385	0.034	2.62	
	WT	6.072	2.484	5.357	2.096	5.712	0.633	0.14	
	RT	51.797	15.951	56.678	11.457	52.394	5.026	0.21	
	EMT	6.301	2.667	5.840	2.475	6.329	0.469	0.07	
Shear	G	1.526	0.420	1.902	0.435	7.155	0.394	227.78***	B B A
	2HG	2.389	0.934	2.791	0.772	9.553	1.538	50.67***	B B A
	2HG5	4.916	1.556	5.582	1.318	14.719	0.852	73.69***	B B A
Bending	B	0.323	0.102	0.384	0.102	0.605	0.162	5.54***	B B A
	2HB	0.156	0.050	0.168	0.053	0.312	0.098	5.96**	B B A
Compression	LC	0.586	0.319	0.427	0.039	0.381	0.085	1.25	
	WC	0.282	0.031	0.183	0.051	0.240	0.010	7.30**	A B AB
	RC	53.286	2.030	51.071	2.011	65.374	2.146	55.65***	B B A
Thickness	T	0.528	0.091	0.552	0.078	0.582	0.089	0.38	
Weight	W	29.307	5.092	29.280	5.338	30.107	5.699	0.03	

*α<0.10, **α<0.05, ***α<0.01

Table 9. The mechanical properties of lyocell-interlining bonded fabric by the mixture rate of lyocell face fabric

The mechanical properties	Sym-bols	Face fabrics of 20's				t-value	Face fabrics of 10's				t-value
		Tencel 100		Tencel/Cotton 65/35			Tencel 100		Tencel/Cotton 65/35		
		Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	Mean	Std Dev	
Tensile	LT	0.330	0.003	0.375	0.015	-7.0086***	0.354	0.020	0.378	0.025	0.1062
	WT	4.255	1.401	6.245	0.320	-3.3919**	5.681	0.908	7.368	0.761	0.0059***
	RT	66.735	5.943	52.200	1.470	5.8162***	49.583	5.433	45.791	3.793	0.1913
	EMT	4.995	2.056	6.856	0.150	-2.2113*	6.197	0.542	7.756	0.708	0.0016***
Shear	G	2.279	0.306	3.075	2.306	-0.6040	2.670	2.143	3.184	1.893	0.6695
	2HG	2.846	2.324	4.622	2.914	-1.0167	4.018	2.690	4.875	2.954	0.6105
	2HG5	5.302	4.040	7.575	3.612	-1.0274	7.569	3.787	8.665	3.333	0.6060
Bending	B	0.376	0.131	0.408	0.109	-0.4582	0.626	0.160	0.551	0.156	0.4242
	2HB	0.149	0.051	0.191	0.059	-1.3387	0.252	0.069	0.290	0.085	0.4180
Compression	LC	0.543	0.256	0.409	0.074	1.2350	0.452	0.037	0.426	0.026	0.1915
	WC	0.266	0.087	0.257	0.032	0.2409	0.276	0.040	0.250	0.026	0.2238
	RC	56.454	6.812	52.454	6.812	0.9602	54.300	5.687	54.316	6.074	0.9962
Thickness	T	0.545	0.081	0.548	0.089	-0.672	0.687	0.068	0.680	0.079	0.8644
Weight	W	28.222	1.801	25.135	1.677	3.0756**	37.012	1.559	32.822	1.792	4.3191***

*α<0.10, **α<0.05, ***α<0.01

Table 10. The mechanical properties of lyocell-interlining bonded fabric by the yarn number of lyocell face fabric

The mechanical properties	Sym-bols	Tencel 100				t-value	Tencel/Cotton 65/35				t-value
		20's		10's			20's		10's		
		Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	Mean	Std Dev	
Tensile	LT	0.330	0.003	0.354	0.020	-2.8042**	0.375	0.015	0.378	0.025	-0.1916
	WT	4.255	1.401	5.681	0.908	-2.0924*	6.245	0.320	7.368	0.761	-3.3265***
	RT	66.738	5.943	49.583	5.433	5.2180***	52.200	1.470	45.791	3.793	3.8581***
	EMT	4.995	2.056	6.197	0.542	-1.3845	6.856	0.150	7.756	0.708	0.0260***
Shear	G	2.279	0.306	2.670	2.143	-0.3082	3.075	0.306	3.184	1.893	0.9304
	2HG	2.846	2.324	4.018	2.690	-0.8073	4.622	2.914	4.875	2.954	0.8841
	2HG5	5.302	4.040	7.569	3.787	-1.0025	7.575	3.612	8.665	3.333	0.5989
Bending	B	0.376	0.131	0.626	0.160	-2.9588**	0.408	0.109	0.551	0.156	0.0979*
	2HB	0.149	0.051	0.252	0.069	-2.9451**	0.191	0.059	0.290	0.085	0.0418**
Compression	LC	0.543	0.256	0.452	0.037	0.8620	0.409	0.074	0.426	0.026	0.6030
	WC	0.266	0.087	0.276	0.040	-0.2591	0.257	0.032	0.250	0.026	0.7267
	RC	56.454	6.812	54.300	5.687	0.5947	52.454	6.812	54.316	6.074	0.6936
Thickness	T	0.545	0.081	0.687	0.068	-3.2767***	0.548	0.089	0.680	0.079	0.0229**
Weight	W	28.222	1.801	37.012	1.559	-9.0364***	25.135	1.677	32.822	1.792	-7.6705***

*α<0.10, **α<0.05, ***α<0.01

fusible interlining, there was significant difference in B, 2HB, WC, and T. As a result of Dunkan grouping, the three groups with differing weight(34, 51, 63 g/m^2) were accepted as separate groups. Table 8, the result of F-test for difference in mechanical properties of lyocell-interlining bonded fabric, subject to the variation of structure(plain weave, twill weave, and non-woven fabric) of fusible interlining, showed that there were significant difference in G, 2HG, 2HG5, B, 2HB, WC, and RC. As a result of Dunkan grouping, no significant difference between the plain and twill weave were accepted, and there was significant difference between woven interlining and non-woven interlining.

<Table 9>, the t-test results of difference in mechanical properties of lyocell-interlining bonded fabric, subject to the variation of mixture rate of lyocell face fabric material showed significant difference in WT, EMT, and W. <Table 10>, the result of t-test for difference in the mechanical properties of lyocell-interlining bonded fabric, subject to the variation of lyocell face fabric yarn number(20's and 10's), showed significant difference in WT, RT, B, 2HB, T, and W.

By putting the results altogether and analyzing, WT is influenced by the mixture rate and yarn number of lyocell face fabric. RT is influenced by the yarn number of lyocell face fabric. G, 2HG, 2HG5 are influence by the structure(woven and non-woven) of fusible interlining. They are increased in the case of non-wovwen fusible interlining. B, HB are influenced by the weight, structure(woven and non-woven) of fusible interlining, and yarn number of lyocell face fabric. They are increased in the case of non-woven fusible interlining, lyocell face fabric 10's, and with incresing weight of woven interlining. WC is influenced by weight, structure of fusible interlining. RC is influenced by the structure of fusible interlining. Thickness is influenced by the weight of fusible interlining and the yarn number of lyocell face fabric. Weight is influenced by mixture rate and yarn number of lyocell face fabric.

IV. Conclusion

This study reached following conclusions.

Drapability and Crease recovery of lyocell-interlining bonded fabric are influenced by the structure of fusible interlining.; stiffness of lyocell-interlining bonded fabric, by the structure of fusible interlining and the yarn number of lyocell face fabric.

WT is influenced by the mixture rate and yarn number of lyocell face fabric. RT is influenced by the yarn number of lyocell face fabric; G, 2HG, 2HG5, by the structure(woven and non-woven) of fusible interlining; B, HB, by the weight, structure(woven and non-woven) of fusible interlining, and yarn number of lyocell face fabric; WC, by the weight, structure of fusible interlining; RC, by the structure of fusible interlining; thickness, by the weight of fusible interlining and the yarn number of lyocell face fabric; weight, by mixture rate and yarn number of lyocell face fabric.

References

Jeong, W. S. (1996). The Bio-finish of tencel fabric by cellulase. *J. Korean Fiber Soc, 33*(5), 458–471.

Kim, I. Y., Oh, S. M., & Song, W. S. (1999). The Bio-softness finish of tencel fabric(part I). *J. Korean Society of Clothing and Textiles, 23*(1), 14–22.

Kim, I. Y. & Song, W. S. (2001). The effect of fusible interlining on the apperance related properties & Mechanical characteristics of the lyocell fabrics(Part I). *J. Korean Society of Clothing and Textiles, 25*(7), 1193–1202.

Kim, I. Y., Oh, S. M., & Song, W. S. (2003). The effect of fusible interlining on the apperance related properties & Mechanical characteristics of the lyocell fabrics(Part II). *J. Korean Home Economics Association, 40*(7), 15–24.

요 약

리오셀직물은 면직물보다 강하고 습윤시 치수안정성이 높으며 우수한 드레이프성, 탁월한 광택, 소프트한 촉감 등 우수한 성능을 가지고 있어 최근 각광받고 있는 신소재 중 하나이다. 그러나 리오셀직물에 관한 연구는 섬유의 성질, 가공·염색방법에 관한 것이 대부분으로, 적합한 봉제방법, 심지선정 등에 관한 연구는 찾아보기 어렵다. 이에 본 연구에서는 겉감으로 시판 리오셀직물 중 숙녀복 수트용으로 사용되고 있는 100% 텐셀직물과 65/35% 텐셀/면 혼방직물 각각에 대해 20수와 10수 모두 4종류를 선정하고, 접착심지로는 중량과 조직을 달리하는 시판 직물심지 5종류와 부직포심지 1종류를 선정하여, 리오셀 심지접착포의 접착심지와 리오셀겉감의 특성에 따른 외관적 성능과 역학적 특성을 측정한 후, 통계적 분석(t-검정, F-검정)에 의해 검정하여 다음과 같은 결론을 얻었다.

1. 리오셀 심지접착포의 드레이프성과 구김회복성은 접착심지의 구조에 영향을 받고, 강연성은 접착심지의 구조와 리오셀겉감을 구성하는 실의 번수에 영향을 받는다.

2. 리오셀 심지접착포의 인장특성중 WT는 리오셀겉감을 구성하는 실의 번수와 혼용률에 영향을 받고, RT는 리오셀 겉감을 구성하는 실의 번수에 영향을 받는다. G, 2HG, 2HG5의 전단특성 모두는 접착심지의 구조(직물과 부직포)에 영향을 받고 B, 2HB의 굽힘특성은 접착심지의 무게, 구조(직물과 부직포)와 리오셀 겉감을 구성하는 실의 번수에 영향을 받는다. 압축특성 중 WC는 접착심지의 무게와 구조에 영향을 받고, RC는 접착심지의 구조에 영향을 받는다. 리오셀 심지접착포의 두께는 접착심지의 무게와 리오셀 겉감을 구성하는 실의 번수에, 리오셀 심지접착포의 무게는 리오셀 겉감의 리오셀 겉감의 혼용률과 구성하는 실의 번수에 영향을 받는다.