COMPARISON OF THE EFFECT OF A SOAP AND A SYNTHETIC DETERGENT UPON THE SERVICE QUALITIES OF A SELECTED COTTON FABRIC TREATED WITH A CREASE-RESISTANT FINISH, AND A SIMILAR COTTON FABRIC NOT TREATED WITH A CREASE-RESISTANT FINISH

by

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INTRODUCTION

A need for rendering fabrics crease-resistant has been in evidence for many years. According to Gagliardi and Nuessle, X. Eschalier was the pioneer in the field of crease-resistant finishes. Since the appearance of Eschalier's French Patent, in 1906, hundreds of patents and processes have appeared in the literature (7).

The authors of the article, "Anti-Wrinkle Textile Resins," which appeared in Fortune, April, 1949 (1) relate an interesting story. It is reported in this reference that the wrinkle-resistant finishes had their beginnings shortly after World War I. Kenneth Lee, director of the Tootal Broadhurst Lee Co., Ltd., of Manchester, England, inquired of Dr. R. S. Willows, a British physicist, the possible reason for wool's recovery to its shape and cotton's lack of recovery. From this conversation emerged a challenging idea. It took these two men and a research staff of about thirty until 1929 to obtain a satisfactory finish to render fabrics, especially those made of cellulose fibers, crease resistant.

The objective of the workers was to find some textile finish "whose 'memory' for its original position reinforced the memory of the fibers" (1). Lee and Willows' accomplishment was not a surface finish but one that penetrated each of the fibers within the cloth as it was desirable not to alter the "hand" and appearance of the fabric. To achieve this it was necessary to discover a resin whose basic chemical unit would dissolve in water, but which, by application of heat, would become water-insoluble. The resin thereby could be incorporated into cloth.

The two common resins that were discovered to have the sought-for effect were phenol formaldehyde and urea formaldehyde. The first patent, U. S. Patent No. 1,134,516, was primarily concerned with phenol formaldehyde whose performance was excellent, but was objectionable because of its inability to retain dye and its slight odor of carbolic acid; this patent, however, also dealt with urea formaldehyde, which is widely used today (1).

In 1932, Lee made an effort to sell or rent his process to a number of United States mills. Because of a national depression, his efforts were in vain. In 1939 with the agreement of royalty payment to the Tootal Broadhurst Lee Co., Ltd., a number of finishers introduced fabrics employing the process. The term "Tebilized" was used to designate fabrics thus finished.

Tebilized fabrics were not particularly popular in their beginning years as Tebilizing added to the cost of the fabric. Also it was discovered in the early forties by American competitors that melamine formaldehyde was more satisfactory for cotton and wool fabrics. With the outbreak of the war the Tootal Broadhurst Company was financially unable to promote its Tebilized trademark. Therefore, the consequent result was the temporary eclipsing of the term Tebilized and the emergence of such terms, as, "Superset" and "Everglaze" (1).

Shiefer (11) states that the process discovered by the Tootal, Lee, Ltd., was "the first to attract attention." The author has concluded from her reading that the preceding broad statement ties together the discrepant statements concerning the origin of the crease-resistant finishes.

The preceding brief history of crease-resistant finishes brings the reader up to the present decade, a decade of more and more patents to overcome the past and present problems of making fabrics wrinkle-resistant.

This particular study, "Comparison of the effect of a soap and a synthetic detergent upon the service qualities of a selected cotton fabric treated with a crease-resistant finish, and a similar cotton fabric not treated with a crease-resistant finish," was undertaken for several reasons. In the first place, very little research, or, at least, very little published research, has been done concerning the effectiveness of crease-resistant finishes on sheer, cotton fabrics. Secondly, more study needs to be done comparing the serviceability of fabrics with crease-resistant finishes with similar fabrics that do not have such finishes. Thirdly, these wrinkle-resistant sheers are becoming increasingly popular; consequently, the consumer will find it helpful to know which detergent gives the best service and the effect that repeated launderings have upon the service qualities of these fabrics.

REVIEW OF LITERATURE

There appears to be considerable data on the subject of crease-resistant finishes. Most of the information is in the form of patents. Very little information concerning the effect of laundering upon these finishes was available. Perdue (10) states that sometimes the finish tends to wear off after a number of washings. It was broadly stated in a patent description that recovery of crease-resistant fabrics was found to be 86 per cent, and after several launderings it was found to be 74 per cent. No comparison of the effect that a soap and a synthetic detergent have upon the crease-resistant finishes was found.

Gagliardi and Nuessle (7) have carried on extensive research on the subject of crease resistance. They have experimented with many agents and have prepared charts and graphs comparing properties of fabrics treated with some thirteen different stabilizing agents. Considering crease-resistant finishes as a whole, they found that the dyeing properties were changed; solubility was decreased; creep and fiber extension was reduced; elastic recovery was raised; dimensional stability was improved; wet strength of the fibers was increased; the general toughness of the fibers was reduced; and the resistance to abrasion and tear at high stress application was lowered. Nuessle (9) has stated that: "Improved recovery is always accompanied by a loss in tear strength;..." He has found that to obtain a high crease recovery with maximum tear strength that it is necessary to select a fabric of good construction and to add a softener in the finishing treatment.

For the verification of laboratory test results of the effectiveness of a crease-resistant finish, Nuessle had two skirts made up. The fabric of half of each skirt was treated with a urea-formaldehyde resin and the fabric of the other half of the skirt was untreated. These skirts were worn by laboratory workers as they went about their usual tasks. The skirts were hung up carefully each night, and were examined each day over four-day wearing periods. It was observed that the treated panels, both before and after laundering, presented a far superior appearance than the panels that were untreated. The creases of the untreated panels were sharper, but there were many, many more creases in the untreated panels, which gave these panels "a mussed, untidy look" which was almost absent from the treated panels (9).

The treatment of fabrics with crease-resistant resins has a tendency to make the fabric somewhat springier and harsher. Consequently, the draping qualities of these treated fabrics are limited (3).

It is interesting to note the numerous times that loss of tensile strength was mentioned in the literature. It is stated that this is one of the primary problems but not an insuperable one (1). Many of the patentees offer solutions or partial solutions to the problem. Contrary to the above statements, it is also interesting to note that one experimenter states, "It should be noted that tensile strength of the individual fibers is generally not reduced by wrinkleproofing and stabilizing agents, and in most cases it is actually increased" (7).

The two most widely accepted crease-resistant resins, urea-formaldehyde and melamine-formaldehyde, also improve dimensional stability (1).

Considering the dyeing of crease-resistant fabrics, Gagliarid and Nuessle inform the reader that the effect of the crease-resistant finishes is one of "immunization against direct dyes" (7). Smith (12) in his article, "Anomalous Light Fastness of Some Dyed Textiles; Effects of Crease-Resisting Resins of the Urea-Formaldehyde Type," reports that "the whole behavior of direct cotton dyes to crease-resisting is baffling... "He verifies the lack of light-fastness of some of the colors, but states that the fastness of other colors is even improved, particularly, the yellow colors. Smith reports exposure to light of most of the blues is disastrous and is unable to give a satisfactory explanation. On the other hand, Perdue (10) who experimented with green dyes reports that the crease-resistant finishes gives certain protection against light.

Chlorine bleaches also, affect the colors. The tendency is for the treated fabrics to yellow (1). According to Perdue, these fabrics tend to retain chlorine which damages the fabric (11).

Perhaps, the findings of Best-Gordon (2) is the answer to some of the conflicting test results of research workers. He found that there was considerable variation even in the same quality of retail fabrics, because of poor distribution of the resins.

One of the most recent and extensive studies of crease-resistance was one made by Nuessle (9). This was a study of resins, datalysts, curing conditions, mercerization, stiffening and softening, and fabric type. According to Nuessle, big-scale application of crease-resistant resins is a new practice, as it has been only in the last three years that cotton yardage has been so treated to any appreciable extent.

METHOD OF PROCEDURE

Procedures recommended by the American Society for Testing Materials, Committee D-13 (4), were followed for all tests with the exception of the measurement of recovery from creasing, which was measured on an apparatus built to meet Federal Specification CCC-T-191-a (5), and the washing procedure for color fastness to washing, which was done according to the new American Association of Textile Chemists and Colorists accelerated washfastness test, No. 3A (8).

Fabric Selection

Two cotton voile fabrics were purchased from retail houses for this study: one sheer fabric to which a commercial crease-resistant finish had been applied and a similar fabric without a crease-resistant finish. The treated fabric was "Tebilized", that is, it was treated with urea-formaldehyde. The treated fabric was light blue, and the untreated fabric was navy blue. Hereafter, the treated fabric will be referred to as A, and the untreated fabric will be referred to as B. Samples of these fabrics are shown in Plate I.

Twenty yards of each of these fabrics were purchased for the testing. The plans used for cutting the specimens for the tests that preceeded and succeeded the launderings are shown in Plate II.

Detergents Used

Two detergents were used for the series of launderings. Ivory Snow was the chosen powdered laundry soap. "Ivory" fulfills Federal specification P-S596a (6); that is, it is made from soda and fats or fatty acids, without resin, and is as free as possible from water and all substances other than true soap. Vel, the synthetic detergent choice, is a coconut oil product, and is a neutral alkyl aryl sulfonate.

Analyses of the Fabrics

The two fabrics, as purchased, were analyzed according to the specification of A.S.T.M. (4) for fiber content, weave, weight per square yard, thread count, yarn number, crimp, twist, shrinkage and colorfastness to light. A load of five grams was the weight used to determine crimp, as it was the lightest weight for the testing apparatus. The fabrics were also analyzed for breaking strength (raveled strip), elongation, percentage of sizing and nonfibrous material, crease resistance, and slippage.

EXPLANATION OF PLATE I

Samples of Fabrics Used

A. Cotton voile treated with a crease-resistant finish

B. Untreated cotton voile

PLATE I

A

B

EXPLANATION OF PLATE II

Diagrams for Cutting Specimens

Diagram 1 - Original specimens

A. Breaking strength, dry and wet

B. Slippage

C. Nonfibrous material

D. Crease resistance

E. Dimensional stability

F. Light fastness

G. Colorfastness to washing

Diagram 2 - Specimens after 1, 3, 5, 10 and 20 washings

A. Breaking strength, dry and wet

B. Slippage

C. Nonfibrous material

D. Crease resistance

PLATE II

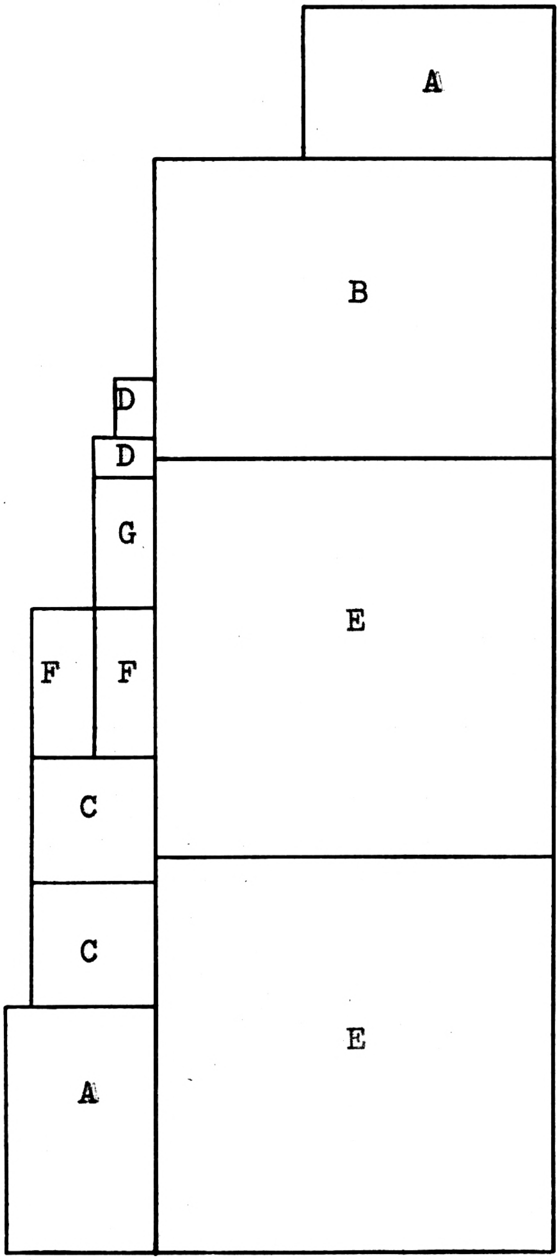

Diagram 1

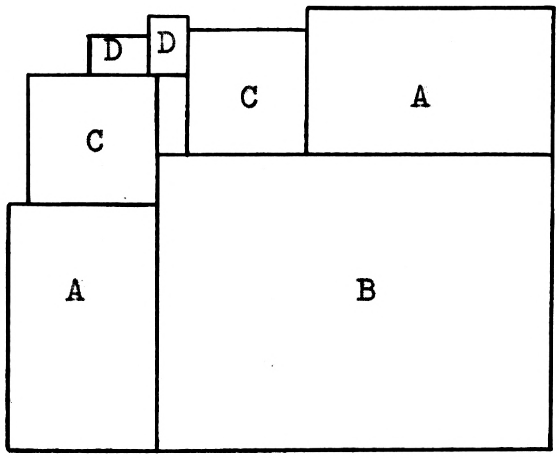

Diagram 2

Laundry Procedure

The laundry method consisted of a 5-minute wash period and three 2-minute rinses. The water temperature for the wash and the first rinse was 120° F. $\pm$ 2° F. The temperature for the second and third rinses was 105° F. $\pm$ 2° F. The fabrics were washed in a domestic automatic-type washer and then spun dried. No softener or bleach was used. The amount of water used was approximately 50 times the weight of the fabric. A standing suds of more than two inches was maintained throughout the 5-minute wash period. The fabrics were dampened and allowed to stand 30 minutes. The specimens were then hand-pressed with an electric iron set at "cotton."

Tests Conducted

The tests that were made after 1, 3, 5, 10 and 20 launderings included dimensional change, dry and wet breaking strength (raveled strip), elongation, crease resistance and slippage. Duplicate specimens of each fabric were prepared and measured for dimensional stability according to the specifications of A.S.T.M. These specimens were then laundered in accordance with the above mentioned procedure. A pendulum testing machine, a product of the Henry L. Scott Co., was used with no additional load for the breaking strength, elongation and slippage tests. The apparatus used for testing recovery from creasing was one produced by the United States Testing Company. Colorfastness to washing and light was judged by five people to be satisfactory or unsatisfactory, when compared to the standards set up by the AATCC (8). Colorfastness was judged after the Launder-Ometer washing, and after each of the 1, 3, 5, 10 and 20 launderings in the automatic washer. The percentage of nonfibrous material was determined after 20 launderings.

FINDINGS AND DISCUSSION

Fabrics A and B were cotton voiles of plain weave. The warp and filling yarns of fabric A were single ply; the warp and filling yarns of fabric B were two ply. Fabric A consisted of 73 warp yarns per inch as compared to B's 68. The filling thread count for each fabric was: A, 73 and B, 52. The warp yarn number of fabric A, typp system, was 54.7; the warp yarn number of B was 39.3. The filling yarn numbers were as follows: A, 51.9 and B, 33.2. Fabric A weighed 1.625 ounces per square yard; B, 1.825.

The crimp of the warp yarns in fabric A was found to be 1.2 per cent; the crimp of fabric B was found to be 1.9 per cent. The percentage of crimp of the filling yarns was: A, 4.9 and B, 5.1. The twist of the warp yarns of fabric A averaged 60 per inch. It was found that the two warp plies of fabric B were twisted together with 40 twists per inch, and that each of the plies had 63 twists per inch. The number of twists per inch of the filling yarns of fabric A was 65. The two filling plies of fabric B were twisted together with 48 twists per inch, and each ply had 48 twists per inch.

Colorfastness was judged by five people to be satisfactory in the light fastness and washfastness tests. Fabric A showed slight color change after exposure to the 20 and 40 hour light tests, and after the washfastness test, but not enough to be declared unsatisfactory, as the change was no greater than the standard with which the specimens were compared. No change could be detected in fabric B.

The results of the A.S.T.M. laboratory method (4) for determining shrinkage are given in Table 1. It is interesting to note that the warp dimensional change was considerably less than the filling change in fabric A, and that the percentage was comparatively close in fabric B. The warp breaking strength of B was over twice as much as A, and the filling breaking strength of B was about one and one-half times as much as A. Fabric B made a greater recovery from creasing.

Table 1. Analyses of the original fabrics.

Tests performed	A		B	
	Warp	Filling	Warp	Filling
Breaking strength in pounds	9.8	5.6	20.6	7.5
Elongation in per cent	6.2	10.2	9.0	17.5
Recovery after creasing in per cent	73.5	61.6	80.8	71.3
Slippage in pounds		9.8		14.8
Dimensional change in per cent	1.8	4.4	3.8	3.3

Nonfibrous Content

The amount of sizing and nonfibrous material which was removed from the original specimens was 11.2 per cent for fabric A and 8.1 per cent for B. After 20 launderings with Ivory soap it was found that sizing and nonfibrous material constituted 7.1 per cent of A and 3.0 per cent of B; with Vel it was 7.0 per cent of fabric A and 5.2 per cent of B. The resin content of the original specimens was found to be: A, 2.1 per cent; and B, 2.2 per cent. After 20 washings with Ivory the resin content was found to be: A, 6.1 per cent; and B, 2.9 per cent. After 20 launderings with Vel, the resin content was found to be: A, 2.8 per cent; and B, 1.8 per cent. These data are presented in Table 2.

Table 2. Percentage of nonfibrous material in the original fabrics and in samples washed 20 times with two detergents.

Fabric	Sizing and nonfibrous material	Resin	Nonfibrous material		Resin	
	Original	Original	Ivory	Vel	Ivory	Vel
A	11.2	2.1	7.1	7.0	6.1	2.8
B	8.1	2.2	3.0	5.2	2.9	1.8

Dimensional Stability

The percentage of dimensional change after 1, 3, 5, 10 and 20 launderings is found in Table 3. The findings, as far as the detergents were concerned, were quite similar. It was found that there was less shrinkage warpwise in fabric A than there was warpwise in B. If the reader will recall, Gagliarde and Nuessle found shrinkage to be diminished in the crease-resistant fabrics (7). It is possible that the lack of stability of the filling yarns of fabric A is due to faulty finishing (2).

Table 3. Dimensional losses given in percentages after 1, 3, 5. 10 and 20 launderings.

No. of wash-ings	A Ivory-washed Warp	A Ivory-washed Filling	A Vel-washed Warp	A Vel-washed Filling	B Ivory-washed Warp	B Ivory-washed Filling	B Vel-washed Warp	B Vel-washed Filling
1	1.3	5.0	1.7	4.7	3.1	3.4	3.0	3.5
3	1.4	5.2	1.7	4.9	3.9	3.7	3.8	4.5
5	1.5	5.5	3.7	4.4	4.2	4.3	2.2	4.9
10	1.5	5.6	1.7	4.6	4.3	3.8	3.9	4.2
20	2.1	6.3	2.2	4.9	5.2	5.1	4.1	4.5

Thread Count

The number of threads per inch taken following the progressive launderings are recorded in Table 4. This table shows a gradual increase of thread count which may account for the results of the breaking strength test.

Table 4. The number of yarns per inch of fabrics A and B using two detergents after 1, 3, 5, 10 and 20 launderings.*

No. of wash-ings	A Ivory-washed Warp	A Ivory-washed Filling	A Vel-washed Warp	A Vel-washed Filling	B Ivory-washed Warp	B Ivory-washed Filling	B Vel-washed Warp	B Vel-washed Filling
1	75.0	74.6	74.8	73.6	68.0	53.4	69.6	52.4
3	75.6	74.8	75.4	74.6	68.6	53.6	68.8	52.4
5	77.0	73.6	75.8	74.6	69.2	53.8	69.4	54.0
10	74.8	74.2	76.2	74.4	68.2	53.8	68.8	54.0
20	75.6	74.8	75.4	74.0	69.8	54.8	70.0	53.6

*Original A warp, 72.8 yarns per inch; filling, 73.4
B warp, 68.2 yarns per inch; filling, 51.8

Breaking Strength

The results of the wet and dry breaking-strength tests have been recorded in Table 5. Figures 1 and 2 graphically show comparison of the two fabrics. The tensile strength of the wet fabrics is greater than the tensile strength of the dry fabrics. It was found that the Vel-laundered fabrics, both dry and wet, showed more resistance to breaking than the Ivory-laundered fabrics. The difference is quite small, but it may be significant because of its consistency. It is interesting to note that in each case the soap-laundered fabrics, dry and wet, lost strength after the third washing and regained strength after the fifth washing. This loss and gain was not evident in the fabrics laundered with the synthetic detergent. With the exception of the warp of fabric B specimens when wet showed more strength after 20 launderings than did the original fabrics. This result is due to shrinkage, which caused the yarns to become more compact. The fact that B had more tensile strength than A is probably due to the structure of the fabric.

Elongation

The mean elongation of the dry sample of A fabric was 6.2 per cent warpwise, and 10.2 per cent fillingwise. The elongation of the wet samples was 8.9 per cent warpwise, and 12.8 fillingwise. The average elongation of B was found to be as follows:

Table 5. Breaking strength, dry and wet, given in pounds and percentage of the original breaking strength.*

Fabric	No. of washings	Ivory-washed Warp pounds	Ivory-washed Warp %	Ivory-washed Filling pounds	Ivory-washed Filling %	Vel-washed Warp pounds	Vel-washed Warp %	Vel-washed Filling pounds	Vel-washed Filling %
					Dry				
A	1	12.9	131.4	5.7	101.8	15.2	154.8	8.5	151.1
	3	8.1	82.3	.7	11.6	15.0	152.5	8.8	157.5
	5	12.5	127.3	4.9	86.6	15.3	156.0	10.8	193.6
	10	15.4	156.4	11.1	198.6	13.7	139.8	9.2	165.0
	20	14.3	146.0	7.2	128.9	15.3	156.1	8.8	138.6
B	1	19.1	92.9	12.1	161.5	25.1	122.3	14.2	190.2
	3	17.3	83.9	5.6	74.9	24.9	121.1	15.9	212.0
	5	19.9	96.8	9.2	122.9	25.2	122.5	15.4	205.2
	10	23.2	112.9	14.0	187.6	23.5	114.4	15.7	209.6
	20	21.7	105.4	13.1	174.7	26.1	127.0	14.7	196.9
					Wet				
A	1	12.2	92.4	2.9	50.0	16.7	126.8	10.7	183.1
	3	9.1	69.3	3.0	51.9	15.8	119.9	11.4	193.9
	5	16.2	123.2	11.2	191.8	15.9	120.6	11.3	193.5
	10	15.0	113.8	9.2	157.0	16.1	122.4	10.3	175.4
	20	13.9	105.4	9.2	156.7	16.6	126.3	10.7	182.9
B	1	23.6	93.4	14.7	122.3	24.0	94.9	16.1	134.0
	3	19.0	75.2	11.4	95.2	28.8	114.0	14.8	122.9
	5	25.9	102.4	16.8	140.3	25.3	100.2	15.2	126.3
	10	24.0	94.9	14.0	116.8	25.5	100.7	15.9	132.5
	20	21.3	84.4	14.1	117.7	28.1	111.3	15.5	129.2

*Original dry A warp, 9.8 pounds; filling, 5.6 pounds
B warp, 20.6 pounds; filling, 7.8 pounds
wet A warp, 13.2 pounds; filling, 5.9 pounds
B warp, 25.3 pounds; filling, 12.0 pounds

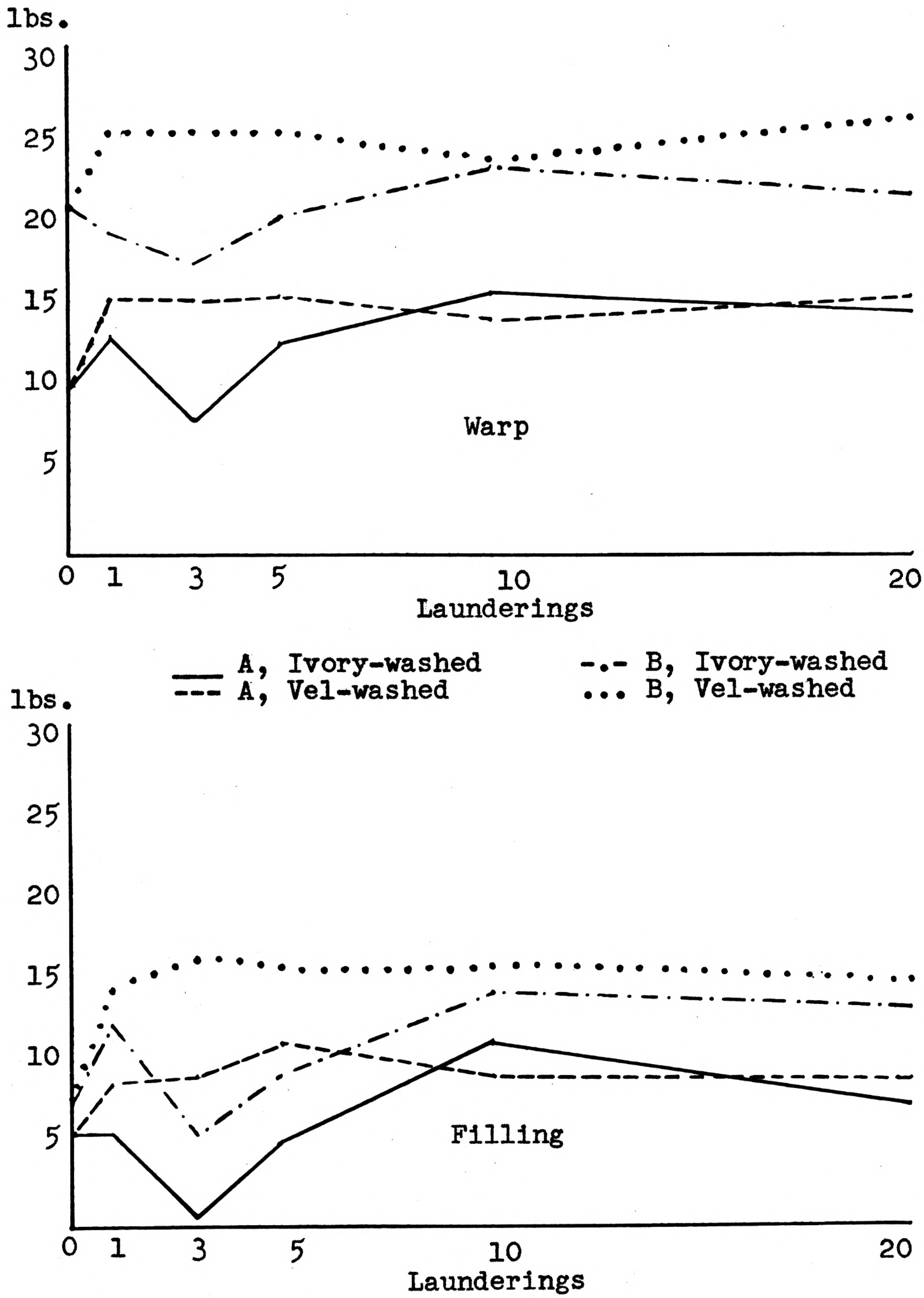

Fig. 1. Dry breaking strength given in pounds after 1, 3, 5, 10 and 20 launderings.

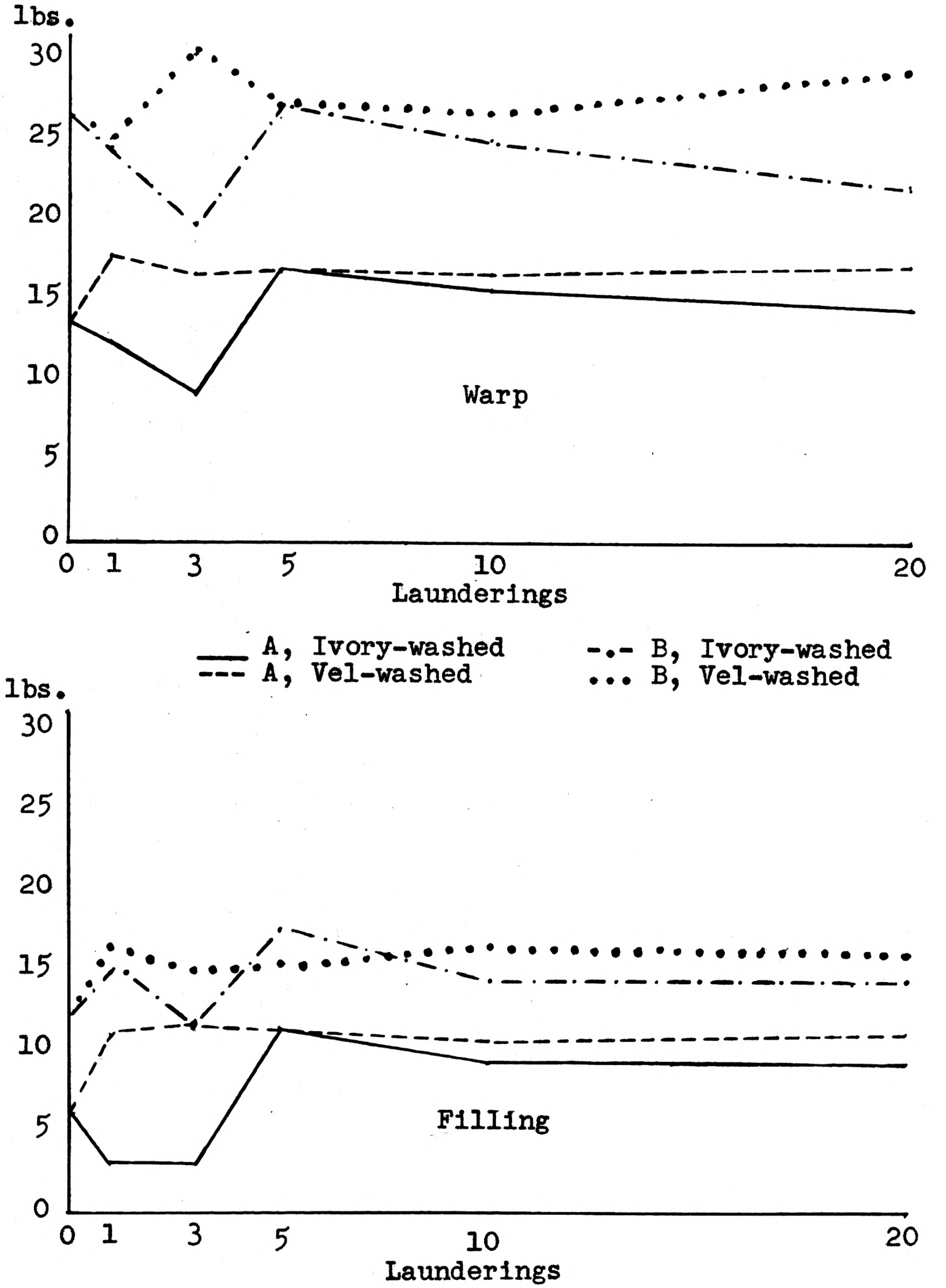

Fig. 2. Wet breaking strength given in pounds after 1, 3, 5, 10, and 20 launderings.

dry, warp samples 9.0 per cent; dry, filling samples, 17.5 per cent: wet, warp samples, 11.8 per cent, and wet, filling samples, 17.3 per cent. Table 6 shows the results of the elongation tests. No marked similarity or dissimilarity of the effect of the two detergents upon the two fabrics was observed. Fabric B tended to have the greater percentage of elongation; this may be due to the difference of the yarns.

Table 6. Percentage elongation of A and B laundered with two detergents after 1, 3, 5, 10 and 20 launderings.*

No. of	A				B			
wash-	Ivory-washed		Vel-washed		Ivory-washed		Vel-washed	
ings	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling
				Dry				
1	6.8	11.6	6.4	10.2	11.0	19.5	10.6	17.7
3	7.1	11.8	6.3	12.2	12.0	18.7	10.9	19.3
5	5.9	11.9	7.2	14.0	8.7	18.1	11.7	18.2
10	7.2	11.9	6.8	13.1	9.5	17.9	11.2	17.1
20	7.1	11.1	6.2	14.2	9.6	17.7	9.6	17.4
				Wet				
1	6.7	12.7	9.1	13.4	11.8	16.7	14.3	21.1
3	7.0	12.2	7.5	13.0	11.7	17.7	15.5	18.5
5	6.0	11.7	7.4	13.5	11.6	15.2	14.9	19.9
10	6.4	11.4	6.8	13.5	11.0	15.2	15.4	19.7
20	6.7	10.0	7.1	13.2	11.0	13.8	15.3	21.0

*Original dry A warp, 6.2 per cent; filling, 10.2 per cent
B warp, 9.0 per cent; filling, 17.5 per cent
wet A warp, 8.9 per cent; filling, 12.8 per cent
B warp, 11.8 per cent; filling, 17.3 per cent

Crease Resistance

The results of the crease-resistance tests are shown in Table 7. Results are presented graphically in Fig. 3. These findings, unless studied carefully, seem to be erratic. However, the recovery of fabric A, warp and filling, remained fairly constant throughout the launderings and the recovery of B, warp and filling, was lessened noticeably as the number of washings progressed.

Table 7. Percentages recovery from creasing of A and B specimens laundered with two detergents after 1, 3, 5, 10 and 20 launderings.*

No. of wash-ings	A				B			
	Ivory-washed		Vel-washed		Ivory-washed		Vel-washed	
	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling
1	73.4	67.3	73.4	60.0	78.1	69.0	70.3	63.3
3	74.8	73.0	74.3	65.0	73.3	65.3	67.0	60.0
5	73.5	73.0	75.8	60.0	70.8	70.6	69.0	63.3
10	75.9	66.5	70.0	64.0	71.5	66.9	67.8	61.0
20	70.3	71.0	74.3	67.8	75.0	62.3	68.3	61.3

*Original A warp, 73.5%; filling 61.6
B warp, 80.8%; filling 71.3

Slippage

Slippage of filling on warp yarns of the unwashed specimens showed some variation. Fabric A withstood tension up to 9.8 pounds; B withstood tension up to 14.8 pounds. The results of the slippage tests have been recorded in Table 8. Figure 4 presents the data graphically. The findings indicated that A was more prone to slippage than B, and that slippage was greater in the fabrics that were laundered with the soap.

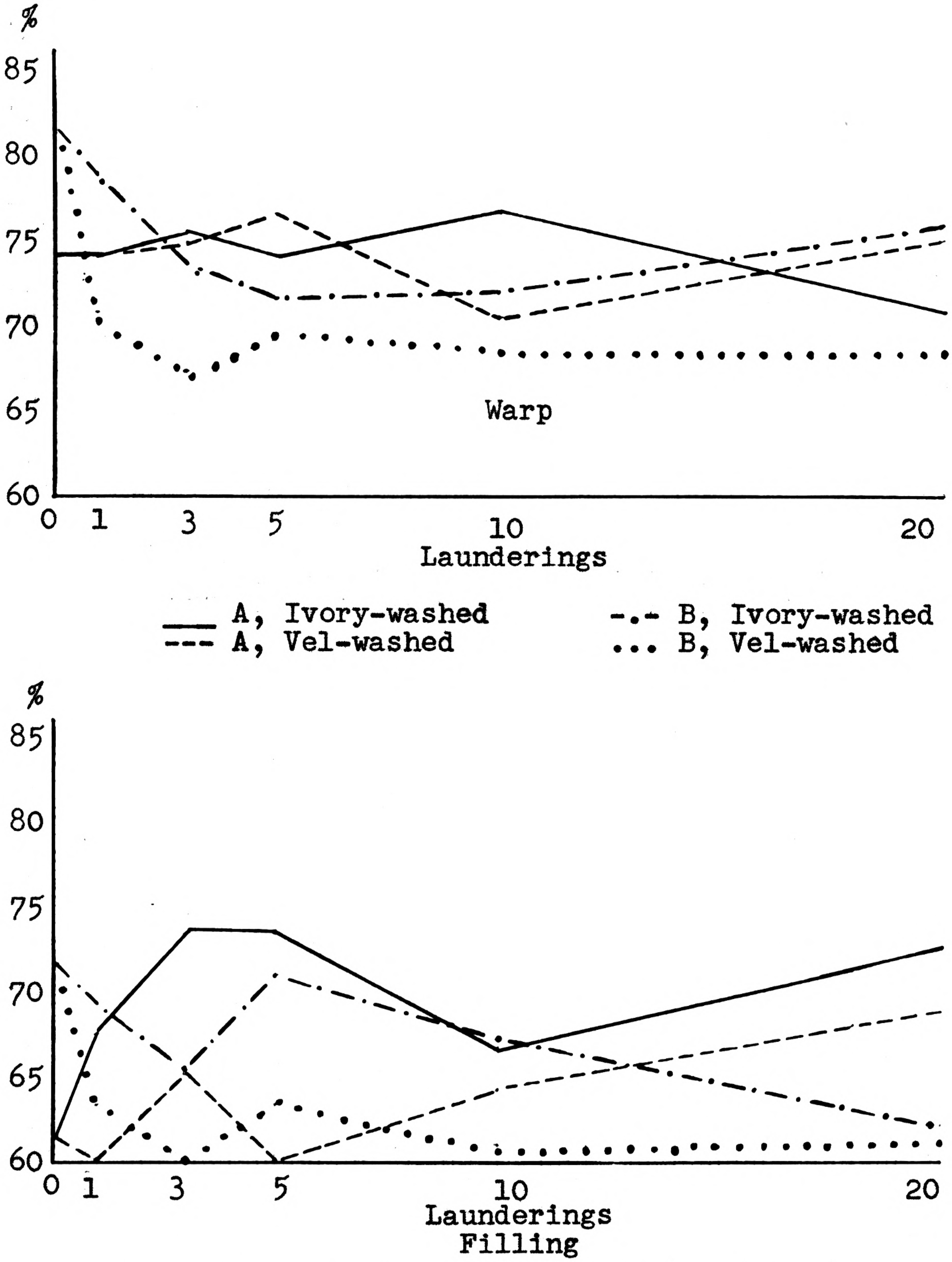

Fig. 3. Percentage of recovery from creasing of the original fabrics and after 1, 3, 5, 10 and 20 launderings.

Table 8. Yarn slippage of A and B specimens, washed with two detergents, given in pounds of tension required for filling yarns to slip one-half of an inch on the warp yarns.*

No. of washings	A Ivory-washed	A Vel-washed	B Ivory-washed	B Vel-washed
1	8.8	12.4	13.8	16.8
3	6.5	14.4	10.0	17.2
5	9.2	11.6	9.6	17.2
10	10.0	12.8	13.3	18.2
20	10.8	14.5	13.0	13.8

*Original A, 9.8 pounds; B, 14.8 pounds

SUMMARY

This study was made to compare the service qualities of a fabric that had been treated with a crease-resistant finish and a similar fabric that had not been so treated. Two cotton voiles were selected for testing. A comparison was also made of the effect of a soap and a synthetic detergent upon the treated and untreated fabrics. Ivory Snow and Vel were the detergents used.

Fabric A, the treated fabric, was made on one-ply yarns, fabric B, the untreated fabric, of two-ply yarns. The warp and filling thread count of fabric B was less than of A. The yarn number, both warp and filling, of fabric A was less than that of B. The weight per square yard of the two fabrics was about the same. The crimp of the two fabrics corresponded rather closely. The warp yarns of the two fabrics had about the same number of twists; the filling yarns of fabric B had fewer twists than A. There was a considerable amount of nonfibrous material in both fabrics, A having the higher percentage.

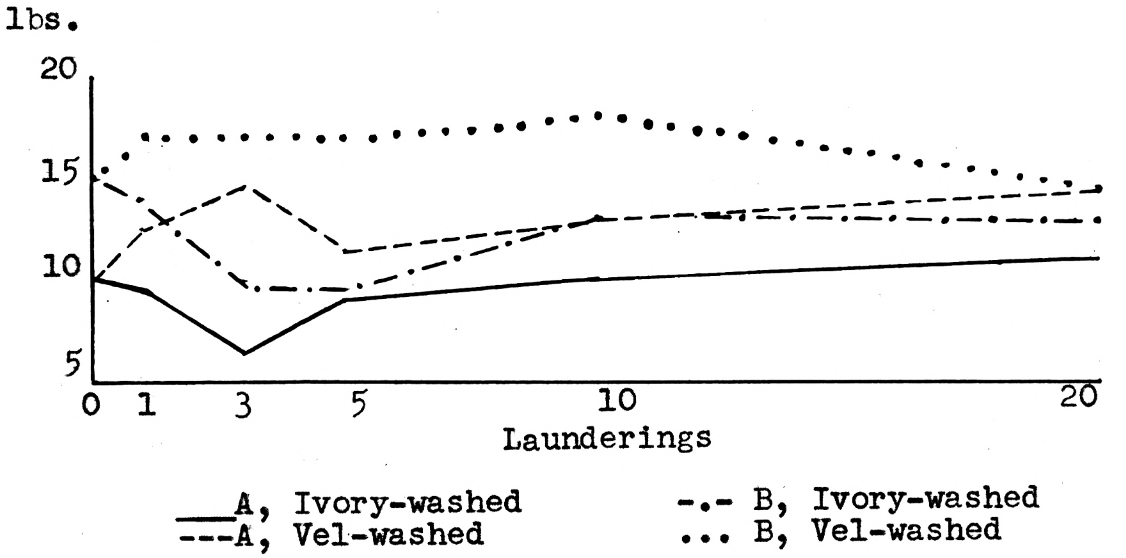

Fig. 4. Slippage given in pounds of tension required for the filling yarns to slip one-half of an inch on the warp yarns after 1, 3, 5, 10 and 20 launderings.

Colorfastness to laundering and light was judged satisfactory for both A and B. Shrinkage results tested by the A.S.T.M. procedure and the laundry procedure described in this thesis corresponded closely. The warp of fabric A shrank less than fabric B; filling shrinkage of the two fabrics was about the same. As the fabrics shrank, the thread count became correspondingly greater. There seemed to be no appreciable difference in shrinkage due to the use of a soap and a synthetic detergent.

The tensile strength of fabric B was greater than that of A, which was probably due to the structure of the yarns. The Vel-laundered fabrics consistently showed a slightly greater tensile strength than did the Ivory-laundered fabrics. Breaking strength of both fabrics increased as the launderings progressed because the yarns became more compact as the fabrics shrank. Fabric B tended to elongate more than A, which, again, was probably due to the difference of yarn structure of the two fabrics. The elongation of both fabrics remained comparatively constant throughout the washings. The two detergents had no appreciable effect upon the test results. The recovery from creasing of the original specimens of fabric B was greater than those of fabric A; however, as the launderings progressed, B's recovery became less and A's recovery remained fairly constant. It was found that fabric B was more prone to yarn slippage than A, and that slippage was greater in the fabrics that were laundered with Vel.

It may be assumed from the analyses of the results obtained in this study that fabrics treated with a crease-resistant finish retain their recovery to creasing better than untreated fabrics after numerous launderings. Both fabrics, the treated and the untreated, had a higher recovery from creasing after being laundered with a soap than after being laundered with a synthetic detergent.

ACKNOWLEDGMENT

Appreciation is expressed to Miss Esther Cormany, Associate Professor of Clothing and Textiles, for her guidance in directing this study.

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ABSTRACT OF THESIS

COMPARISON OF THE EFFECT OF A SOAP AND A SYNTHETIC DETERGENT UPON THE SERVICE QUALITIES OF A SELECTED COTTON FABRIC TREATED WITH A CREASE-RESISTANT FINISH, AND A SIMILAR COTTON FABRIC NOT TREATED WITH A CREASE-RESISTANT FINISH

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INTRODUCTION

Crease-resistant fabrics are becoming more and more prevalent on the market today. Very little is known about the service qualities of these fabrics. Therefore, this study was made to compare the service qualities after a series of launderings of a fabric that had been treated with a crease-resistant finish and a similar fabric that had not been so treated. A comparison was also made of the effect of two detergents, one a soap and the other a synthetic, upon the treated and untreated fabric.

MATERIALS AND PROCEDURE

Two cotton voile fabrics, one treated and the other untreated, were chosen for this study. The treated fabric was Tebilized: that is, it was treated with urea-formaldehyde. Ivory Snow and Vel were the detergents used.

Procedures recommended by the American Society for Testing Materials were followed for all tests with the exception of (1) the measurement of crease-resistance, which was measured on an apparatus built to meet Federal Specification CCC-T-191-a, and (2) washfastness, which was done according to the accelerated washfastness Test No. 3A of the American Association of Textile Colorists and Chemists. The original fabrics were analyzed for fiber content, weave, weight per square yard, thread count, yarn number, crimp, twist, dimensional stability, washfastness and colorfastness to light. The original fabrics were also analyzed for dry and wet breaking strength (raveled strip), elongation, crease resistance and slippage.

The laundry procedure consisted of a 5-minute wash period and three 2-minute rinses. The water temperature for the wash and the first rinse was 120° F. ± 2° F. The temperature for the second and third rinses was 105° F. ± 2° F. The fabric was washed in a domestic automatic-type washer and then spun dry. No softener or bleach was used. The amount of water used was approximately 50 times the weight of the fabric. A standing suds of more than two inches was maintained throughout the 5-minute wash period. The fabrics were dampened and allowed to stand 30 minutes. They were hand-pressed with an electric iron set at "cotton."

Fabrics after 1, 3, 5, 10 and 20 launderings were analyzed for washfastness, dimensional stability, dry and wet breaking strength (raveled strip), elongation, crease resistance and slippage. The percentage of nonfibrous material was determined after 20 launderings.

FINDINGS AND SUMMARY

The treated fabric was constructed, warp and filling, of one-ply yarns; the untreated fabric was constructed of two-ply yarns. The warp and filling thread count of the untreated fabric was less than that of the treated fabric; the warp thread count was slightly less and the filling thread count was considerably less. The treated fabric had a higher yarn number. The weight per square yard of the two fabrics was about the same. The crimp of the two fabrics compared rather closely. Each of the two-plies of the untreated fabric had about the same number of twists per inch as the one-ply yarns of the treated fabric. It was found that there was a considerable amount of nonfibrous material in both fabrics: the treated fabric had a higher percentage of sizing, resin and other nonfibrous material.

Colorfastness to laundering and light was judged satisfactory. The warp of the treated fabric shrank less than the warp of the untreated fabric. Filling shrinkage of the fabrics was about the same. No appreciable difference in shrinkage was observed between the two laundering procedures: that is, the method prescribed by A.S.T.M. and the laundering procedure described above. Also there seemed to be no marked difference in shrinkage between the detergents that were used.

The tensile strength of the untreated fabric was greater than the treated fabric, probably due to the construction of the yarns. The Vel-laundered fabrics showed slightly greater tensile strength than the Ivory-washed fabrics. Elongation was greater in the untreated fabric than in the treated fabric. There appeared to be no appreciable difference in elongation because of the detergent used. The percentage of recovery from creasing of the original untreated fabric was higher than the percentage of recovery of the treated fabric. However, as the launderings progressed, the recovery from creasing of the untreated fabric became less and the recovery of the treated fabric remained fairly constant. The treated fabric tended to slip more than the untreated fabric. Slippage was greater in the fabrics that were laundered with Ivory.

It may be concluded from the findings of this study that the fabrics that have been treated with a crease-resistant finish do retain this finish throughout a number of launderings and that this retention is slightly greater in the fabrics that have been washed with soap than in the fabrics that were laundered with a synthetic detergent.