COMPARISON OF THE SERVICE QUALITIES OF CERTAIN ALL SILK AND ALL RAYON DRESS FABRICS BEFORE AND AFTER DRY CLEANING

by

EVELYN EMMA STOUT

B. S., Kansas State College
of Agriculture and Applied Science, 1938

A THESIS

submitted in partial fulfillment of the

requirements for the degree of

MASTER OF SCIENCE

Department of Clothing and Textiles

KANSAS STATE COLLEGE
OF AGRICULTURE AND APPLIED SCIENCE

1941

TABLE OF CONTENTS

INTRODUCTION

Rayon was first used commercially for dress fabrics in the United States in the early twenties of the present century. Its use has become increasingly important, largely replacing all other fibers except cotton for those families in the middle and low income groups. Rayon first surpassed silk consumption in 1927, and by 1940 fourteen times as much rayon as silk was used in this country. At present the largest proportion of silk is consumed by the hosiery industry. For dresses, viscose and cellulose acetate rayons have most affected the yard goods market.

The increased use of rayon may be attributed to three reasons: first, the irregularity of the silk market and high prices due to world conditions; second, the improved and constantly decreasing cost of rayon production; and third, the desirable finishes now attained in rayons (27). Some of the most outstanding of the improvements are: delustering; water-repellency; resistance to shrinkage, elongation, fraying, and slippage; crepiness; finer denier yarns; and greater wet and dry breaking strength. A new finish, iron-proofing, promises much for the future of acetate rayon. In addition to the improvements, a greater variety of effects may now be obtained in rayon fabrics than in any others.

Although rayons have not been as serviceable as pure dye silks, they are generally considered as serviceable as is desired for dress fabrics in our rapidly changing fashions of this modern era (22). Moderately weighted silks are also generally considered

to have sufficient serviceability for satisfactory use as dress fabrics (29). Rayon has supposedly largely replaced tin-weighted silk fabrics, except those of satin construction, on the retail market (34).

Various types of rayon crepes, satins, and taffetas have especially increased in importance for dress fabrics. The rayon satins have often been found to wear better than silk satins, due to the denser warp yarns used in rayon which are prohibitive for silk satin because of price (6). Rayon has been slower to enter into the silk crepe field than in that of other fabrics because it has been difficult to crepe. This disadvantage has now been largely overcome, and Carlson (10) found as attractive rayon crepes as silk crepes available on the market.

In an editorial of a textile magazine (48) it has been predicted that synthetic fibers may eventually replace all natural fibers, with the possible exception of cotton, in the fabric field. This prediction is based upon the possibility of completely controlling synthetic processes so that all results will be uniform. This is not now possible with natural fibers (11).

There have been few studies made comparing the qualities of fabrics of all silk and all rayon, and no studies were reported comparing materials of these fibers of specific types. The purpose of this study was to compare the service qualities of taffeta, flat crepe, and satin crepe fabrics made of pure dye silk, weighted silk, viscose rayon, and cellulose acetate rayon; and also to determine the effect of dry cleaning upon the service qualities of these fabrics.

PRESENT STATUS OF KNOWLEDGE

Many investigations of silk and rayon have been made, some bearing upon this problem and others having little relation to it, but few have compared pure dye and weighted silk fabrics with the two kinds of rayon considered in this study.

Some of the studies made were: fiber conductivity of heat and electricity (47, 50); the effect of humidity on elongation of silk and rayon (31), and of climatic exposure on strength of fibers 949); and the effects of light (19), ultra-violet radiation (39), and perspiration (46), either singly or combined (12) on weighted and unweighted silk. Weighted silks were more often found to be undesirably affected by the various treatments used upon them than were unweighted silks.

Studies of the effects of dry cleaning and of different dry cleaning solvents upon silks and rayons were made by Goldman, Hubbard, and Schoffstall (18), Hughes and Appel (25), Ramsay and Mack (33), and by Barr, Marshall, and Edgar (8). In general, they found that dry cleaning does not affect the serviceability of fabrics, that no solvent is uniformly superior, and that age apparently is a major factor in deterioration of weighted silk. Both pure dye silk and weighted silk were less harmed by steam pressing than by dry heat.

Dennen (15) compared one rayon and cotton mixed fabric with silk crepe de chine and silk satin crepe. She found that rayon union goods deteriorated less rapidly in breaking strength when

abraded than did the other fabrics under the same conditions.

Searle and Mack (42) reported a study of shrinkage in 570 women's and children's wearing apparel fabrics purchased between September 1936 and September 1938. Of these fabrics 269 were tested for shrinkage by dry cleaning and 301 by laundering. More than half of the dry cleaned fabrics showed two per cent or less shrinkage, which was considered as negligible. Less shrinkage occurred in water-sponged fabrics that had previously been dry cleaned than in those water-sponged and not previously dry cleaned. Weave was found to be a factor in shrinkage; crepes shrank most and a plain weave cellulose acetate rayon least. A mixed acetate and viscose rayon gave the poorest performance.

In a study of the serviceability of fall and winter dress fabrics similar to those found on the market at the time of the experiment, Dodson (16) reported that reasonable serviceability may be expected from all types of silk or rayon fabrics. Some of the tests made on 82 silk and rayon fabrics were: thread count, breaking strength, weighting, slippage, and effect of dry cleaning. Silks were designated as 'pure dye' or 'weighted', but all types of rayon were designated as 'rayon' so that it was not possible to compare one type of rayon with another. Forty-three fabrics showed slippage at 20 pounds or less, which fact made them undesirable for fitted garments. Dry cleaning 'wet' caused much more shrinkage than dry cleaning 'dry'.

Whitlock (51) reported a study made between the years 1931 and 1934 on the wearability of 20 silk dresses made from eight pieces of silk, of which two pieces were pure dye silk and the

other six weighted from 41 to 47 per cent. All except one - a spun silk - were flat crepe. Among the tests made on all fabrics were: yarn slippage, effect of weighting, breaking strength of new, used aged, and unused aged fabrics, shrinkage, and elongation. Wear records were kept on the dresses. Variations in wear were found to be unpredictable as activity of the wearer, hours worn, and whether hard or easy on clothes seemed to make no difference. Nine dresses showed slippage at the seams; unused aged silks had greater breaking strength than used aged silks; and no silk garment stretched, but shrinkage was a serious problem in two of the eight fabrics tested.

Adams and Craynor (1) studied stretch and yarn slippage of 24 wool, silk, rayon, and mixture fabrics, and of worn garments made of these fabrics. Less trouble was reported for rayon than for silk dresses. More stretch and slippage occurred in plain than in other weaves, but more faults in dresses were reported for flat crepe fabrics. Stretch and slippage, which were reported for a large proportion of the garments, occurred in all cases at points of strain. The deterioration of breaking strength and elongation was greater for worn than for unworn fabrics. Of all the fabrics tested for abrasion, regenerated cellulose rayon was most resistant and silk was least resistant.

A series of studies of silk and rayon fabrics and garments begun in 1930 and carried on over an eight year period has been reported by Pennsylvania State College (37). Forty-nine silk flat crepe dresses purchased in the spring of 1930 were tested in

the laboratory for probability of service. Three of the dresses were pure dye silk and the other 46 were weighted silk. All of these dresses could be dry cleaned satisfactorily when new, but ageing caused the highly weighted silks to rupture when dry cleaned, although pure dye silks rated well in durability tests.

One hundred each of discarded silk and rayon dresses were studied (37) by means of questionnaires given to the owners, and by laboratory tests. Of all the medium to heavily weighted silks, only 16 per cent had a measurable breaking strength when discarded. Fifty-three per cent of the pure dye silks had a measurable breaking strength at that time. In days of actual wear the pure dye silks gave 208 days of service as compared with 127 days for weighted silk. The rayon dresses, of undesignated weave, were discarded chiefly because of seam slippage and low wet breaking strength. The test used for seam slippage did not accurately predict the service that might be expected as a result of laboratory tests.

In a group of 30 pure dye and weighted silk fabrics (37), ageing tests showed medium and heavily weighted silks to be low in durability, and serviceability did not vary according to the amount of weighting contained.

Dauner (14) in a study of flat crepe rayon slips which were tested by actual wear and by laboratory tests, found that viscose rayon gave better service than an acetate and viscose mixture. The acetate wore in holes near the seams. This was probably due to frequent ironing of the slips.

Carlson (10) made a study of four pieces each of printed pure dye silk and printed viscose rayon dress crepes in which tests were made for shrinkage, breaking strength, elongation, slippage, and resistance to abrasion. Shrinkage in the filling direction was approximately the same for silk and rayon, but rayons shrank much more warpwise than did the silks. Dry cleaning had no effect on the breaking strength of either silk or rayon, but tended to increase the elongation of both groups. None of the materials showed slippage.

PROCEDURE

The original plan was to obtain twelve white materials of similar weight, appearance, and handle, commonly found available on the retail market as yard goods or in ready-made dresses. One fabric each of taffeta, flat crepe, and satin crepe construction in pure dye silk, weighted silk, cellulose acetate rayon, and viscose rayon were to be studied.

Microscopical analysis of fiber and weighting tests were run before the final choice of materials was made. All tested silk taffetas sold as 'pure dye silk' contained too much weighting to warrant the use of that term and were not included in this study. Neither an all acetate rayon satin nor an all viscose rayon satin crepe could be found on the market, so a satin crepe with acetate warp and viscose filling was used in their place.

The acetate rayon crepe was heavier in weight and appearance than the other flat crepes but had a thread count comparable to

the viscose rayon flat crepe. White fabrics were selected so that results obtained might not be influenced by the dye used. The weighted silk satin crepe was cream-white.

Four to four and one-fourth yard swatches of each material were purchased from stores in Manhattan, Topeka, and Wichita, Kansas, St. Louis, Missouri, and New York City. Samples of the fabrics studied are shown in Plates I and II.

Analysis of Fabrics

The fabrics were analyzed to determine fiber content, thread count, width, thickness, yarn counts, crimp, twist, weight per square yard, kind and percentage of weighting of silks, and kind and percentage of finishing materials of rayons.

Fiber analysis, thread count, weight per square yard, slippage, and thickness tests were made according to standard laboratory tests accepted by Committee D-13 (4). Fiber identification was made by the Viviani cork section method (41).

All thread counting except satin crepes was done by using a thread counter. The satin crepes were so closely woven that the separate yarns could not be distinguished by the usual method, so small pieces were staggered from over the entire yardage, raveled to exactly one inch in the direction in which thread count was desired, then raveled and counted thread by thread to determine the number of threads per inch. The thread counting for the controls of satin crepes was done on the eight inch squares of fabrics raveled for yarn counts. In the acetate rayon flat crepe warp two threads had been used as one, but were not twisted

EXPLANATION OF PLATE I

Fig. 1. Weighted silk taffeta

Fig. 2. Acetate rayon taffeta

Fig. 3. Viscose rayon taffeta

Fig. 4. Pure dye silk satin crepe

Fig. 5. Weighted silk satin crepe

Fig. 6. Acetate and viscose rayon satin crepe

PLATE I

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

EXPLANATION OF PLATE II

Fig. 1. Pure dye silk flat crepe

Fig. 2. Weighted silk flat crepe

Fig. 3. Acetate rayon flat crepe

Fig. 4. Viscose rayon flat crepe

PLATE II

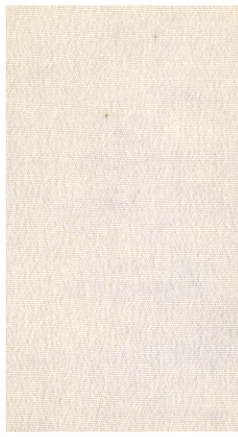

Fig. 1

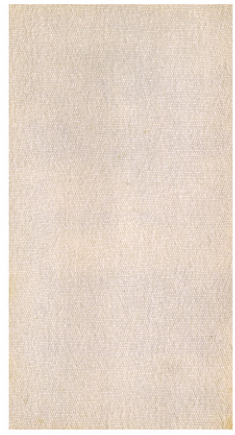

Fig. 2

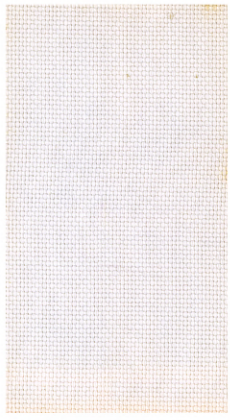

Fig. 3

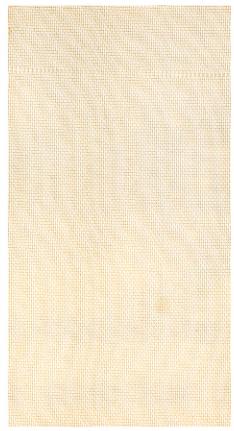

Fig. 4

together, so both were counted as separate threads.

Twist was determined by means of a Suter twist counter. The number of turns per inch was determined by finding the turns in a ten inch length of yarn and dividing by the length of the yarn, as in the method described by Haven (23). Ten determinations were made in both warp and filling directions for each fabric.

Yarn counts were calculated as follows: Eight inch squares of each fabric were measured and cut. These were dried to constant weight, raveled, warp and filling yarns separated, and counted. Each set of yarns was then dried to constant weight and the very slight loss in weight was equally divided between warp and filling. Total length was found from number of yarns, length of sample, and crimp. Yarn counts was calculated in deniers from the total length and dry weight of the yarns.

Crimp or waviness of yarns was ascertained by use of the camera lucida attachment for a microscope, and the percentage of crimp was determined as in the method described by Schwarz (40).

Chemical analysis for determination of kind and percentage of weighting in the silk fabrics was made according to a method presented by Mease (28), by which both soluble finishing materials and inorganic materials were determined.

Quantitative determination of sizing and finishing of rayons was done according to methods approved by the American Association of Textile Chemists and Colorists (3).

Serviceability Tests

Tests were made on the controls and after one, five, and ten dry cleanings for wet and dry breaking strength, elongation, shrinkage, resistance to abrasion, weight per square yard, thread count, and thickness. Slippage tests were made after one dry cleaning only as it was believed that any finishing material which might prevent slippage would have been removed at the first dry cleaning unless it were a permanent finish.

As it was desired that these materials be treated as much like dresses as possible, all were sent to the Manhattan Dry Cleaners where they were cleaned with light colored clothing and pressed with the steam press in the same manner as dresses. Care was taken to neither stretch nor shrink the fabric in the pressing. Stoddard solvent was the fluid used for cleaning.

Shrinkage was determined by marking off a ten inch square one-tenth of the width of the fabric from the selvedge. Each of these squares was carefully measured after one, five, and ten dry cleanings to determine shrinkage, and from these measurements percentage calculations were made.

Measurement of dry, wet, and abraded breaking strength, and elongation tests were made by the raveled strip method accepted by Committee D-13 (4).

Abrading was done on an abrasion machine designed at the Massachusetts Institute of Technology, by a method described by

Skinkle (43). Strips of fabric six by 24 inches were abraded 200 strokes over a one-inch roller at constant tension, with crocus cloth as the abradant. Several materials wore through or tore and had to be mended before abrasion could be finished.

All breaking strength, abrasion, twist, slippage, and elongation tests were made under standard conditions of relative humidity and temperature.

FINDINGS AND DISCUSSION

Analysis of Materials

All materials tested in this study were purchased in June 1939 at prices from 20 cents to $2.00 per yard, and varied from 38½ to 40 inches in width. Fabric analysis is shown in Table 1.

Warp thread count of the controls for all fabrics ranged from 94.2 threads per inch for viscose rayon flat crepe to 408.0 threads per inch for pure dye silk satin crepe. Filling thread count varied from 44.1 threads per inch for acetate rayon flat crepe to 127.9 threads per inch for weighted silk satin crepe.

Highest thread count for the taffetas was 200.8 warp threads per inch for acetate rayon and 94.1 filling threads per inch for weighted silk. Viscose rayon had the lowest warp and filling thread count with 110.4 and 52.0 threads per inch, respectively.

In the flat crepe group, pure dye silk had the highest warp and filling thread count, with 211.6 and 93.2 threads per inch. Viscose rayon had the lowest warp and acetate rayon the lowest filling thread count, with 94.2 and 44.1 thread per inch, respectively.

Table 1. Description and data of physical characteristics of fabrics.

Fabric	Where purchased	Price per yd.	Width (ins.)	Thickness (ins.)	Weave	Weight (oz. per sq. yd.)	Thread count		Crimp (per cent)		Twist (per in.)		Yarn counts (deniers)		Weighting, sizing or finishing (per cent)		
							Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Soluble	Total	Qualitative
Weighted silk taffeta	Chas. F. Welek's St. Louis, Mo.	$1.95	39½	.0050	$\frac{1}{1}$	1.95	181.5±0.3	94.1±0.4	8.3	2.5	S 15	S 3	29.7	95.7	3.1	45.1	tin phosphate silicate
Acetate taffeta	Ward Keller's Manhattan, Kans.	0.59	39½	.0069	$\frac{1}{1}$	2.76	200.8±0.5	60.0±0.1	5.1	3.5	S 4	S 3	66.7	106.7		00.62 ...	sulfonated oil cane sugar calcium or barium
Viscose taffeta	Cohn-Hall, Marx Co. New York City	0.19½	38½	.0070	$\frac{1}{1}$	2.94	110.4±0.6	52.0±0.1	3.2	7.6	S 3	S 3	131.1	129.3		1.91 ...	sulfonated oil cane sugar glycerine calcium or barium
Pure dye silk flat crepe	Chas. F. Welek's St. Louis, Mo.	1.35	39	.0079	$\frac{1}{1}$	1.86	211.6±0.6	93.2±0.3	15.4	23.0	0	S 75* Z71	32.7	48.2-	7.0	8.1 ...	tin phosphate
Weighted silk flat crepe	Crosby Bros. Co. Topeka, Kans.	1.00	38½	.0073	$\frac{1}{1}$	3.44	179.0±1.3	78.6±0.3	13.8	10.2	S 1	Z 71 S 71	91.3	86.4	4.8	65.8 ...	tin silicate lead phosphate
Acetate flat crepe	Rorabaugh-Buck Wichita, Kans.	0.59	39½	.0113	$\frac{1}{1}$	5.15	104.0±0.3	44.1±0.1	7.3	8.6	S 3	S ply 8 S single 12	181.8	382.8		1.79...	sulfonated oil cane sugar ethylene or di-glycol calcium or barium
Viscose flat crepe	Crosby Bros. Co. Topeka, Kans.	0.49	39¼	.0060	$\frac{1}{1}$	2.52	94.2±0.5	71.8±0.1	5.6	7.2	S 5	S 5	87.9	131.6		2.07...	sulfonated oil cane sugar calcium or barium magnesium
Pure dye silk satin crepe	Chas. F. Welek's St. Louis, Mo.	2.00	38¾	.0091	$\frac{(7)}{(1)_3}$	2.78	408.0	113.3±0.4	3.9	8.3	0	S 71 Z 69	32.4	54.8	4.9	5.8 ...	tin phosphate
Weighted silk satin crepe	Crosby Bros. Co. Topeka, Kans	1.69	39	.0109	$\frac{(7)}{(1)_5}$	4.24	410.0	127.9±0.6	5.3	7.9	0	S 77 Z 72	41.5	109.4	5.6	55.5 ...	silicate tin phosphate
Acetate & viscose satin crepe	Crosby Bros. Co. Topeka, Kans.	1.25	40	.0128	$\frac{(4)}{(1)_2}$	4.50	305.0	72.9±0.3	7.5	4.7		S 55 Z 55	68.7	140.4		0.66 ..	sulfonated oil cane sugar glycerine calcium or barium magnesium

*Silk flat crepes and satin crepes had filling yarns of S twist alternating with Z twist.

In the satin crepes, pure dye silk had 408.0 warp threads per inch and weighted silk had 127.9 filling threads per inch, the highest in the group. Acetate and viscose mixed rayon had 305.0 warp and 72.9 filling threads per inch, both of which were the lowest for the group.

In no case were the warp and filling threads balanced, but in all fabrics except viscose rayon flat crepe, the warp tended to run at least twice as high as filling thread count. Viscose rayon flat crepe was the most nearly balanced of the fabrics studied. It had a warp thread count of 94.2 and filling of 71.8 threads per inch. Warp thread count for all materials is shown in Table 2 and that of the filling in Table 3.

Thickness varied from .0050 inch for weighted silk taffeta to .0128 inch for acetate and viscose rayon mixed satin crepe. In all cases except one, the thickness became somewhat greater with increased number of dry cleanings; while with abrasion and dry cleanings, some became thicker and some thinner.

Acetate rayon flat crepe had both the highest warp and the highest filling yarn counts of all materials studied. This had been expected as it was heavier and coarser in feel and appearance than the other fabrics. Acetate rayon flat crepe warp yarn counts was 181.1 deniers and filling 382.8 deniers. Lowest warp and filling yarn counts were found in weighted silk taffeta and pure dye silk flat crepe, which were 29.7 and 48.2 deniers, respectively.

Crimp of warp yarns varied from 3.2 per cent for viscose rayon taffeta to 15.4 per cent for pure dye silk flat crepe; and

Table 2. Warp thread count and breaking strength of dry, wet, and abraded samples of all fabrics, of the controls, and after dry cleanings.

Fabric	No. dry cleanings	Thread count (per inch)		Warp breaking strength (pounds)					
				Dry		Wet		Abraded	
			Abraded		Corrected		Corrected		Corrected
Weighted silk taffeta	0	181.5±0.3	183.8±0.6	31.0±0.39	31.0	16.4±1.01	16.4	5.0±0.32	5.0
	1	183.6±1.3	181.8±0.3	30.3±0.18	30.0	18.3±1.00	18.1	4.7±0.86	4.8
	5	182.7±0.4	184.3±0.5	32.9±0.29	32.7	20.7±1.05	20.6	9.3±0.90	9.3
	10	185.2±0.4	183.8±0.3	26.4±0.86	25.9	12.0±0.74	11.8	13.7±1.23	13.7
Acetate taffeta	0	200.8±0.5	203.1±0.4	36.3±0.40	36.3	18.0±0.77	18.0	12.1±0.65	12.1
	1	204.1±0.7	202.0±0.1	32.9±0.36	32.4	21.5±0.50	21.2	10.6±0.50	10.7
	5	205.3±0.4	202.7±0.3	33.5±0.42	32.7	17.0±0.57	16.6	15.2±0.35	15.2
	10	208.5±0.8	201.2±0.4	33.8±0.31	32.6	17.2±0.50	16.6	10.1±0.63	10.2
Viscose taffeta	0	110.4±0.6	111.0±0.0	68.4±0.71	68.4	31.2±1.24	31.2	33.7±1.91	33.7
	1	112.7±0.3	112.0±0.0	69.7±0.55	68.3	30.1±0.67	29.5	38.5±1.72	38.2
	5	108.2±0.2	109.3±0.1	63.0±0.98	64.3	26.2±0.85	26.7	29.6±1.56	30.1
	10	114.7±0.5	108.0±0.0	57.7±1.17	55.5	24.9±0.75	24.0	29.6±2.00	30.4
Pure dye silk flat crepe	0	211.6±0.6	211.3±0.4	44.2±0.60	44.2	22.6±1.20	22.6	26.9±0.46	26.9
	1	213.9±0.6	214.0±0.2	46.4±0.65	45.9	31.8±0.74	31.5	22.0±0.65	21.7
	5	210.9±0.4	214.2±0.3	44.5±1.59	44.6	27.1±0.66	27.2	21.0±1.86	20.7
	10	212.4±1.0	215.5±0.3	38.3±1.48	38.2	23.3±1.77	23.2	17.7±1.79	17.4
Weighted silk flat crepe	0	179.0±1.3	183.7±0.6	44.5±0.45	44.5	23.9±1.77	23.9	17.6±0.11	17.6
	1	184.6±0.7	185.1±0.6	44.3±0.84	43.0	23.9±0.95	23.2	29.7±2.38	29.5
	5	193.5±0.7	189.5±0.3	45.9±0.47	42.5	28.9±0.62	26.7	22.2±1.81	21.5
	10	195.0±0.8	186.0±0.1	40.3±2.09	37.0	21.1±0.47	19.4	14.3±1.03	14.1
Acetate flat crepe	0	104.0±0.3	102.4±0.3	40.0±0.57	40.0	27.9±0.66	27.9	31.6±0.42	31.6
	1	104.0±0.2	104.6±0.1	40.9±0.83	40.9	26.5±0.43	26.5	34.0±1.29	33.3
	5	103.6±0.3	104.6±0.3	40.2±0.34	40.4	25.1±0.35	25.2	33.1±0.36	32.4
	10	103.4±0.3	104.2±0.2	41.0±0.20	41.2	25.1±0.36	25.2	33.6±0.37	33.0

Table 2 (cont.)

Fabric	No. dry cleanings	Thread count (per inch)		Warp breaking strength (pounds)					
				Dry		Wet		Abraded	
			Abraded		Corrected		Corrected		Corrected
Viccose flat crepe	0	94.2±0.5	96.0±0.6	32.3±0.09	32.3	9.8±0.43	9.8	7.6±0.79	7.6
	1	96.9±0.4	92.9±0.4	31.4±0.22	30.5	9.2±0.86	8.9	13.2±1.22	13.6
	5	92.9±0.4	92.3±0.4	29.1±0.27	29.5	7.4±0.75	7.5	10.7±1.65	11.1
	10	93.9±0.4	96.0±0.0	31.2±0.34	31.3	8.5±0.51	8.5	11.1±1.05	11.1
Pure dye silk satin crepe	0	408.0±0.0	413.4±0.3	112.3±5.10	112.3	75.9±3.29	75.9	81.4±1.43	81.4
	1	424.3±1.6	414.6±2.1	120.0±2.53	115.4	58.0±3.26	55.8	80.0±2.49	79.8
	5	416.2±3.8	414.6±2.6	124.5±3.42	122.0	85.0±0.30	83.3	82.6±1.06	82.4
	10	407.0±2.5	411.6±2.2	121.3±1.72	121.6	75.8±1.45	76.0	84.3±1.62	84.7
Weighted silk satin crepe	0	410.0±0.0	395.7±3.3	70.1±0.36	70.1	31.7±1.61	31.7	22.4±0.23	22.4
	1	392.9±2.3	398.0±4.4	77.9±0.65	81.3	35.7±0.79	37.3	21.9±0.76	21.8
	5	397.2±1.5	400.0±0.4	76.4±0.55	78.9	35.6±1.05	36.7	37.5±2.17	36.1
	10	398.2±3.1	397.7±2.6	68.6±0.81	70.6	37.9±0.80	39.0	20.4±0.52	20.3
Acetate & viscose satin crepe	0	305.0±0.0	308.1±2.5	50.7±0.94	50.7	32.6±0.31	32.6	36.4±0.61	36.4
	1	313.2±1.9	298.0±1.3	50.9±0.58	49.6	24.9±1.30	24.2	33.0±0.32	34.1
	5	313.1±0.9	305.4±2.2	52.8±0.74	51.4	28.6±0.81	27.9	38.9±0.58	39.2
	10	317.5±2.6	309.5±2.6	52.2±0.91	50.1	30.5±0.85	29.3	27.3±0.77	27.2

Table 3. Filling thread count and breaking strength of dry, wet, and abraded samples of all fabrics, of the controls, and after dry cleanings.

Fabric	No. dry cleanings	Thread count (per inch)		Filling breaking strength (pounds)					
				Dry		Wet		Abraded	
			Abraded		Corrected		Corrected		Corrected
Weighted silk taffeta	0	94.1±0.4	92.8±0.3	39.5±0.67	39.5	28.6±1.30	28.6	32.6±0.99	32.6
	1	93.6±0.4	92.5±0.4	39.2±0.61	39.4	32.8±0.75	33.0	34.5±0.83	34.6
	5	91.8±0.3	95.4±0.3	41.2±0.21	42.2	31.1±0.33	31.9	32.6±0.55	31.7
	10	91.1±0.4	98.6±0.6	43.1±0.52	44.5	29.6±0.49	30.6	39.5±1.30	37.2
Acetate taffeta	0	60.0±0.1	59.1±0.0	19.4±0.12	19.4	8.0±0.15	8.0	14.2±0.16	14.2
	1	60.9±0.1	60.0±0.0	19.1±0.13	18.8	8.7±0.19	8.6	15.4±0.39	15.2
	5	61.6±0.3	60.0±0.0	19.0±0.26	18.5	6.9±0.18	6.7	13.5±0.55	13.3
	10	62.1±0.0	61.0±0.0	20.0±0.12	19.3	8.4±0.13	8.1	15.3±0.83	14.8
Viscose taffeta	0	52.0±0.1	51.5±0.2	28.9±0.28	28.9	15.5±0.17	15.5	24.7±0.49	24.7
	1	53.1±0.0	52.0±0.0	29.2±0.37	28.6	12.2±0.26	11.9	19.7±1.10	19.5
	5	54.3±0.3	54.0±0.1	30.3±0.17	29.0	12.4±0.18	11.9	27.5±0.23	26.2
	10	55.6±0.2	56.2±0.1	28.7±0.78	26.8	13.3±0.19	12.4	29.3±0.26	26.8
Pure dye silk flat crepe	0	93.2±0.3	91.3±0.2	21.0±0.02	21.0	16.2±0.25	16.2	12.5±0.57	12.5
	1	95.9±0.4	94.0±0.1	21.5±0.43	20.9	15.1±0.26	14.7	16.3±0.18	15.8
	5	95.8±0.3	93.3±0.1	27.3±0.46	26.6	15.1±0.33	14.7	14.6±0.61	14.3
	10	94.6±0.3	94.7±0.2	24.8±0.47	24.4	13.7±0.35	13.5	12.4±0.44	12.0
Weighted silk flat crepe	0	78.6±0.3	78.7±0.2	14.7±0.20	14.7	8.7±0.25	8.7	8.9±0.07	8.9
	1	79.3±0.5	79.7±0.1	13.5±0.29	13.4	8.5±0.14	8.4	9.1±0.06	9.0
	5	80.3±0.4	81.7±0.3	12.5±0.31	12.2	6.1±0.20	6.0	8.7±0.24	8.4
	10	81.0±0.2	81.0±0.1	14.9±0.31	14.5	6.2±0.23	6.0	9.5±0.22	9.2
Acetate flat crepe	0	44.1±0.1	44.0±0.0	26.9±0.36	26.9	19.8±0.10	19.8	19.3±0.43	19.3
	1	44.3±0.1	44.0±0.0	28.1±0.18	28.0	18.2±0.11	18.1	22.5±0.73	22.5
	5	45.0±0.0	44.1±0.0	29.9±0.35	29.3	15.7±0.37	15.4	22.5±0.45	22.4
	10	44.7±0.2	45.0±0.0	32.1±0.05	31.7	17.0±0.24	16.8	21.4±0.70	20.9

Table 3 (cont.)

Fabric	No. dry cleanings	Thread count (per inch)		Filling breaking strength (pounds)					
				Dry		Wet		Abraded	
			Abraded		Corrected		Corrected		Corrected
Viscose flat crepe	0	71.8±0.1	71.3±0.2	31.8±0.11	31.8	12.0±0.25	12.0	9.0±0.69	9.0
	1	71.1±0.4	66.5±0.6	32.3±0.16	32.6	10.9±0.74	11.0	13.5±1.17	14.5
	5	73.7±0.4	75.6±0.1	32.4±0.51	31.6	10.8±0.35	10.5	13.3±0.96	12.5
	10	73.3±0.5	73.6±0.2	32.3±0.24	31.6	11.0±0.34	10.8	12.8±0.73	12.4
Pure dye silk satin crepe	0	113.3±0.4	113.4±0.3	33.1±0.44	33.1	29.1±0.54	29.1	35.1±0.27	35.1
	1	117.1±0.4	115.7±0.3	31.4±0.38	30.4	22.8±0.40	22.1	27.4±0.60	26.9
	5	113.9±0.8	116.3±0.2	34.9±0.46	34.7	24.7±0.50	24.6	28.7±0.58	28.0
	10	114.4±0.5	118.1±0.3	34.1±0.45	33.8	24.4±0.39	24.2	30.3±0.58	29.1
Weighted silk satin crepe	0	127.9±0.6	119.2±0.1	20.5±0.40	20.5	16.0±0.18	16.0	5.1±0.77	5.1
	1	118.5±0.2	119.3±0.2	18.1±0.40	19.5	14.6±0.24	15.8	6.9±0.41	6.9
	5	122.5±0.4	121.4±0.1	15.6±0.42	16.3	12.8±0.19	13.4	4.3±0.28	4.2
	10	119.8±0.8	120.9±0.3	19.3±0.56	20.6	14.1±0.25	15.1	13.6±0.24	13.4
Acetate & viscose satin crepe	0	72.9±0.3	72.0±0.2	18.9±0.16	18.9	8.9±0.25	8.9	4.2±0.18	4.2
	1	74.2±0.2	73.2±0.1	15.9±0.35	15.6	6.7±0.23	6.6	9.6±0.29	9.4
	5	75.3±0.2	73.7±0.1	18.4±0.31	17.8	5.6±0.15	5.4	5.6±0.21	5.4
	10	77.0±0.6	80.4±0.3	17.8±0.17	16.9	5.5±0.21	5.5	16.8±0.25	16.8

crimp of filling yarns varied from 2.5 per cent for weighted silk taffeta to 10.2 per cent for weighted silk flat crepe. Yarn counts and crimp for all fabrics are shown in Table 1.

Weighted silk taffeta warp yarns had 15 turns per inch, but other fabrics had little or no warp twist. In all cases, warp yarns had S twist. The twist of the filling yarns varied from three turns per inch for each of the taffetas to 77 turns per inch for the S twist of weighted silk satin crepe. All crepes had two S twist filling yarns alternating with two Z twist filling yarns. This was no doubt responsible for the pebbled effect. All fabrics were of plain weave except the satin crepes.

Weight varied from 1.86 oz. per sq. yd. for pure dye silk flat crepe to 4.50 oz. per sq. yd. for acetate and viscose rayons mixed satin crepe. Acetate and viscose rayon taffeta were of similar weight, but weighted silk taffeta was considerably less. There was considerable difference between the flat crepes. The acetate rayon which was heaviest, weighed 3.44 oz. per sq. yd., and pure dye silk, which was lightest, weighed 1.86 oz. per sq. yd. Weighted silk satin crepe and acetate and viscose rayon mixed satin crepe weighed about the same, but again, the pure dye silk of similar construction weighed less.

Weight per square yard, as compared with the controls, increased slightly in all fabrics after five and ten dry cleanings, but decreased in several fabrics after the first dry cleaning. This was especially true of all the weighted silks. This decrease followed by increase is believed to have been due to removal of weighting and finishing materials at the first dry

cleaning which was accompanied by a relatively small amount of shrinkage. No additional removal of weighting and finishing materials occurred with successive dry cleaning, but shrinkage did increase noticeably.

Thickness, weight per square yard, and shrinkage are shown in Table 4, and elongation in Table 5.

Serviceability Tests

Examination of all fabrics was made after one, five, and ten dry cleanings, and results were compared with the controls. The weighted silk satin crepe became increasingly glossy with additional dry cleanings; the viscose rayon taffeta showed some separation of warp and filling yarns at various places in the fabric. It was interesting to note that, contrary to the usual opinion, viscose rayon flat crepe became yellow with cleaning and age, although yellowing could not be discerned in any other fabric. The yellowing of viscose rayon was believed due to some other factor than dry cleaning as the control yellowed almost as much as those dry cleaned. Houston (24) had found that white viscose rayon was more changed by light and heat than acetate rayon. Carlson (10) had found that the white in viscose rayon prints remained white when cleaned.

Breaking strength data for all treatments and dry cleanings was corrected to the thread count of the controls before comparisons were made. This was done by the following formula:

$$\text{Corrected breaking strength} = \frac{\text{Breaking strength of sample to be corrected} \times \text{thread count of control}}{\text{thread count of sample to be corrected}}$$

Table 4. Thickness, weight per square yard, and shrinkage for all fabrics, of the controls, and after dry cleanings.

Fabrics	Thickness (inches)				Weight (oz. per sq. yd.)				Shrinkage (per cent)					
		Dry cleanings				Dry cleanings			Dry cleanings					
	Controls	1	5	10	Controls	1	5	10	1		5		10	
									Warp	Filling	Warp	Filling	Warp	Filling
Weighted silk taffeta	.0050	.0051	.0050	.0050	1.947	1.937	2.010	2.037	0.0	0.0	0.0	0.0	1.2	0.0
Acetate taffeta	.0069	.0071	.0071	.0073	2.755	2.720	2.797	2.845	0.0	0.0	0.6	0.0	1.2	0.0
Viscose taffeta	.0070	.0077	.0092	.0098	2.937	2.996	3.014	3.104	1.2	0.6	1.9	-2.5	7.5	-3.8
Pure dye silk flat crepe	.0079	.0085	.0082	.0082	1.859	1.894	1.872	1.890	2.5	1.2	2.5	0.6	2.5	1.2
Weighted silk flat crepe	.0073	.0074	.0083	.0079	3.437	3.430	3.570	3.537	0.0	0.6	1.2	2.5	1.2	2.5
Acetate flat crepe	.0113	.0117	.0121	.0118	5.150	5.075	5.162	5.195	1.2	1.2	1.2	1.9	0.6	1.2
Viscose flat crepe	.0060	.0066	.0073	.0067	2.519	2.497	2.516	2.523	1.2	0.6	3.8	-1.2	2.5	1.2
Pure dye silk satin crepe	.0091	.0104	.0109	.0113	2.780	2.790	2.814	2.892	0.6	0.0	2.5	1.2	1.2	1.2
Weighted silk satin crepe	.0109	.0114	.0122	.0123	4.236	4.193	4.350	4.402	0.0	1.2	1.2	2.5	1.2	3.8
Acetate & viscose satin crepe	.0128	.0138	.0141	.0164	4.501	4.647	4.815	5.475	6.9	1.9	2.5	2.5	7.5	10.0

Table 5. Elongation in inches and per cent for dry, wet, and abraded samples of all fabrics of the controls and after dry cleanings.

Fabric	No. dry cleanings	Elongation in inches and per cent											
		Treatment											
		Dry				Wet				Abraded			
		Warp		Filling		Warp		Filling		Warp		Filling	
		inches	%	inches	%	inches	%	inches	%	inches	%	inches	%
Weighted silk taffeta	0	0.61±0.02	20.3	0.36±0.02	12.0	1.00±0.00	33.3	0.81±0.00	27.0	0.12±0.01	4.0	0.21±0.01	7.0
	1	0.58±0.01	19.3	0.41±0.01	13.7	0.78±0.00	26.0	1.03±0.02	34.3	0.20±0.04	6.7	0.26±0.02	8.7
	5	0.56±0.01	18.7	0.19±0.02	6.3	0.90±0.00	30.0	0.98±0.01	32.7	0.15±0.01	5.0	0.11±0.01	3.7
	10	0.48±0.00	16.0	0.13±0.00	4.3	0.54±0.03	18.0	0.94±0.02	31.3	0.23±0.02	7.7	0.27±0.02	9.0
Acetate taffeta	0	0.54±0.02	18.0	0.77±0.01	25.7	0.86±0.03	28.7	0.99±0.02	33.0	0.14±0.01	4.7	0.68±0.01	22.7
	1	0.61±0.01	20.3	0.73±0.00	24.3	1.06±0.00	35.3	1.07±0.02	35.7	0.10±0.01	3.3	0.58±0.02	19.3
	5	0.62±0.01	20.7	0.66±0.01	22.0	0.91±0.03	30.3	1.01±0.02	33.7	0.13±0.01	4.3	0.55±0.04	18.3
	10	0.71±0.01	23.7	0.74±0.01	24.7	1.08±0.00	36.0	1.01±0.03	33.7	0.10±0.01	3.3	0.56±0.01	18.7
Viscose taffeta	0	0.49±0.01	16.3	0.52±0.00	17.3	0.66±0.03	22.0	0.54±0.01	18.0	0.26±0.02	8.7	0.45±0.01	15.0
	1	0.52±0.01	17.3	0.51±0.01	17.0	0.58±0.00	19.3	0.49±0.02	16.3	0.33±0.01	11.0	0.38±0.02	12.7
	5	0.60±0.01	20.0	0.47±0.01	15.7	0.59±0.01	19.7	0.47±0.01	15.7	0.38±0.02	12.7	0.52±0.01	17.3
	10	0.69±0.02	23.0	0.48±0.02	16.0	0.65±0.02	21.7	0.50±0.01	16.7	0.48±0.03	16.0	0.49±0.01	16.3
Pure dye silk flat crepe	0	0.54±0.01	18.0	0.56±0.01	18.7	0.91±0.03	30.3	1.09±0.02	36.3	0.37±0.01	12.3	0.45±0.01	15.0
	1	0.63±0.01	21.0	0.61±0.01	20.3	0.81±0.02	27.0	0.81±0.02	27.0	0.33±0.00	11.0	0.50±0.03	16.7
	5	0.61±0.01	20.3	0.67±0.01	22.3	0.76±0.02	25.3	0.81±0.01	27.0	0.40±0.03	13.3	0.41±0.02	13.7
	10	0.58±0.02	19.3	0.60±0.01	20.0	0.68±0.00	22.7	0.76±0.02	25.3	0.34±0.02	11.3	0.45±0.01	15.0
Weighted silk flat crepe	0	0.46±0.02	15.3	0.43±0.01	14.3	0.93±0.00	31.0	0.88±0.01	29.3	0.13±0.01	4.3	0.16±0.00	5.3
	1	0.52±0.02	17.3	0.33±0.01	11.0	0.98±0.01	32.7	0.86±0.01	28.7	0.26±0.02	8.7	0.18±0.00	6.0
	5	0.46±0.01	15.3	0.32±0.01	10.7	1.06±0.03	35.3	0.65±0.02	21.7	0.19±0.01	6.3	0.23±0.01	7.7
	10	0.43±0.00	14.3	0.31±0.01	10.3	0.75±0.02	25.0	0.70±0.02	23.3	0.10±0.00	3.3	0.24±0.01	8.0
Acetate flat crepe	0	0.32±0.04	10.7	0.30±0.02	10.0	0.90±0.02	30.0	0.95±0.01	31.7	0.26±0.01	8.7	0.18±0.02	6.0
	1	0.49±0.02	16.3	0.53±0.01	17.7	0.83±0.01	27.7	0.84±0.01	28.0	0.47±0.03	15.7	0.41±0.03	13.7
	5	0.50±0.01	16.7	0.51±0.00	17.0	0.83±0.01	27.7	0.79±0.01	26.3	0.48±0.00	16.0	0.39±0.02	13.0
	10	0.52±0.00	17.3	0.46±0.01	15.3	0.92±0.01	30.7	0.83±0.02	27.7	0.32±0.03	10.7	0.27±0.02	9.0

Table 5 (cont.)

Fabric	No. dry cleanings	Elongation in inches and per cent											
		Treatment											
		Dry				Wet				Abraded			
		Warp		Filling		Warp		Filling					
		inches	%	inches	%	inches	%	inches	%	inches	%	inches	%
Viscose flat crepe	0	0.47±0.01	15.7	0.54±0.01	18.0	0.27±0.01	9.0	0.40±0.01	13.3	0.18±0.01	6.0	0.13±0.01	4.3
	1	0.41±0.01	13.7	0.51±0.01	17.0	0.29±0.02	9.7	0.38±0.02	12.7	0.16±0.02	5.3	0.26±0.01	8.7
	5	0.48±0.01	16.0	0.51±0.01	17.0	0.28±0.02	9.3	0.38±0.02	12.7	0.20±0.02	6.7	0.20±0.01	6.7
	10	0.48±0.01	16.0	0.50±0.01	16.7	0.30±0.02	10.0	0.38±0.01	12.7	0.14±0.00	4.7	0.13±0.00	4.3
Pure dye silk satin crepe	0	0.53±0.00	17.7	0.62±0.01	20.7	0.95±0.02	31.7	1.09±0.02	36.3	0.47±0.05	15.7	0.67±0.02	22.3
	1	0.58±0.02	19.3	0.62±0.01	20.7	0.98±0.00	32.7	0.86±0.01	28.7	0.39±0.02	13.0	0.55±0.01	18.3
	5	0.58±0.01	19.3	0.63±0.01	21.0	0.90±0.01	30.0	0.85±0.01	28.3	0.39±0.01	12.7	0.64±0.01	31.3
	10	0.58±0.01	19.3	0.57±0.01	19.0	0.88±0.02	29.3	0.82±0.02	27.3	0.33±0.02	11.0	0.58±0.01	19.3
Weighted silk satin crepe	0	0.28±0.01	9.3	0.30±0.01	10.0	0.68±0.04	22.7	1.01±0.01	33.7	0.11±0.00	3.7	0.24±0.01	8.0
	1	0.41±0.01	13.7	0.25±0.01	8.3	0.70±0.00	23.3	0.83±0.00	27.7	0.11±0.01	3.7	0.26±0.01	8.7
	5	0.31±0.01	10.3	0.27±0.01	9.0	0.81±0.03	27.0	0.77±0.02	25.7	0.16±0.00	5.3	0.19±0.01	6.3
	10	0.27±0.01	9.0	0.27±0.00	9.0	0.78±0.00	26.0	0.90±0.01	30.0	0.10±0.01	3.3	0.32±0.01	10.7
Acetate & viscose satin crepe	0	0.69±0.02	23.0	0.62±0.01	20.7	0.92±0.04	30.7	0.90±0.26	30.0	0.42±0.02	14.0	0.17±0.01	5.7
	1	0.70±0.01	23.3	0.53±0.01	17.7	1.04±0.01	34.7	0.63±0.01	21.0	0.35±0.01	11.7	0.43±0.03	14.0
	5	0.67±0.02	22.3	0.53±0.01	17.7	1.10±0.02	37.7	0.45±0.01	15.0	0.53±0.02	17.7	0.23±0.01	7.7
	10	0.89±0.03	29.7	0.63±0.01	21.0	1.23±0.00	41.0	0.53±0.01	17.7	0.36±0.01	12.0	0.81±0.01	27.0

Because seam slippage has been a leading complaint against silk and rayon garments, slippage tests were made on both warp and filling strips of all fabrics. There was no slippage of either warp or filling yarns in any fabric.

Statistical Analysis

Statistical analysis was made of breaking strength, elongation, and shrinkage data for each group of fabrics. Grouping was done according to type of fabric, i.e., taffeta, flat crepe, and satin crepe. Data were evaluated by the analysis of variance (17, 44). A probability of five per cent variability was considered significant, one per cent highly significant, and one-tenth per cent very highly significant in the interpretation of differences.

Breaking strength. The data for breaking strength of taffetas are shown in Table 6. Table 7, shows the results of the analysis of data for breaking strength of taffetas.

Table 6. Breaking strength of dry, wet, and abraded taffeta samples of controls, and after dry cleanings.

No. dry cleanings	Types of Material																Totals	Means	Sum of Squares
	Weighted silk taffeta						Acetate taffeta						Viscose taffeta						
	Dry		Wet		Abraded		Dry		Wet		Abraded		Dry		Wet		Abraded		
	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	
0	31.0	39.5	16.4	28.6	5.0	32.6	36.3	19.4	18.0	8.0	12.1	14.2	68.4	28.9	31.2	15.5	33.7	24.7	463.5	25.8	59808.95
1	30.0	39.4	18.1	33.0	4.8	34.6	32.4	18.8	21.2	8.6	10.7	15.2	68.3	28.6	29.5	11.9	38.2	19.5	462.8	25.7	
5	32.7	42.2	20.6	31.9	9.3	31.7	32.7	18.5	16.6	6.7	15.2	13.3	64.3	29.0	26.7	11.9	30.1	26.2	459.6	25.5	
10	25.9	44.5	11.8	30.6	13.7	37.2	32.6	19.3	16.6	8.1	10.2	14.8	55.5	26.8	24.0	12.4	30.4	26.8	441.2	24.5	
	119.6	165.6	66.9	124.1	32.8	136.1	134.0	76.0	72.4	31.4	48.2	57.5	256.5	113.3	111.4	51.7	132.4	97.2			
	285.2		191.0		168.9		210.0		103.8		105.7		369.8		163.1		229.6		1827.1		
			645.1						419.5						762.5						
Means	29.9	41.4	16.7	31.0	8.2	34.0	33.5	19.0	18.1	7.8	12.1	14.4	64.1	28.3	27.8	12.9	33.1	24.3			
	35.7		23.9		21.1		26.3		13.0		13.2		46.2		20.4		28.7				
			26.9						17.5						31.8						

Means		
	Dry	36.0
	Wet	18.2
	Abraded	21.0
	Warp	27.1
	Filling	23.7

Table 7. Results of analysis of breaking strength of taffetas.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Fabrics (weighted silk, acetate, and viscose)	2	2532.32	1266.16	113.85***
Dry cleanings (0, 1, 5, 10)	3	18.45	6.15	
Treatments (dry, wet, abraded)	2	4139.59	2069.80	192.18***
Warp vs. filling	1	204.35	204.35	18.97***
Fabrics x dry cleanings	6	72.17	12.03	1.17
Fabrics x treatments	4	520.88	130.22	12.09***
Fabric x warp vs. filling	2	4269.82	2134.91	198.23***
Dry cleanings x treatments	6	59.05	9.84	
Dry cleanings x warp vs. filling	3	68.52	22.84	2.12
Treatments x warp vs. filling	2	1127.74	563.87	52.36***
Error	40	430.86	10.77	
	71	13443.75		

* significant
** highly significant
*** very highly significant

The following methods were used for finding the sums of squares:

Correction: $C = \frac{(SX)^2}{n} = \frac{1827.1^2}{72} = 59808.95.$

Total: $SX^2 - C = 59808.95 - 46365.20 = 13443.75.$

Fabrics: $\frac{645.1^2}{24} + \frac{419.5^2}{24} + \frac{762.5^2}{24} - C = 2532.32$

Dry cleanings: $\frac{463.5^2}{18} + \frac{462.8^2}{18} + \frac{459.6^2}{18} + \frac{441.2^2}{18} - C = 18.45$

Treatments: $\frac{865.0^2}{24} + \frac{457.9^2}{24} + \frac{504.2^2}{24} - C = 4139.59$

Warp vs. filling: $\frac{974.2^2}{36} + \frac{852.9^2}{36} - C = 204.35$

Fabrics x dry cleanings: $\left[\frac{153.1^2+159.9^2+168.4^2+163.7^2}{6} + \frac{108.0^2+106.9^2+103.0^2+101.6^2}{6} + \frac{202.4^2+196.0^2+188.2^2+175.9^2}{6} - C\right] - \left[2532.32 + 18.45\right] = 72.17$

Fabrics x treatment: $\left[\frac{285.2^2+191.0^2+168.9^2}{8} + \frac{210.0^2+103.8^2+105.7^2}{8} + \frac{369.8^2+163.1^2+229.6^2}{8} - C\right] - \left[2532.32 + 4139.59\right] = 520.88$

Fabrics x warp vs. filling: $\left[\frac{219.3^2+425.8^2}{12} + \frac{254.6^2+164.9^2}{12} + \frac{500.3^2+262.2^2}{12} - C\right] - \left[2532.32 + 204.35\right] = 4269.82$

Dry cleanings x treatments: $\left[\frac{223.5^2+117.7^2+122.3^2}{6} + \frac{217.5^2+122.3^2+123.0^2}{6} + \frac{219.4^2+114.4^2+125.8^2}{6} - C\right] - \left[18.45+4139.59\right] = 59.05$

Dry cleanings x warp vs. filling: $\left[\frac{252.1^2+211.4^2}{9} + \frac{253.2^2+209.6^2}{9} + \frac{248.2^2+211.4^2}{9} + \frac{220.7^2+220.5^2}{9} - C\right] - \left[18.45 + 204.35\right] = 68.52$

Treatments x warp vs. filling: $\left[\frac{510.1^2+354.9^2}{12} + \frac{250.7^2+207.2^2}{12} + \frac{213.4^2+290.8^2}{12} - C\right] - \left[4139.59 + 204.35\right] = 1127.74$

In Table 7 the F-test of significance was used. This showed a very highly significant difference in breaking strength of different fabrics and in warp vs. filling. Dry cleaning had no apparent effect upon the various fabrics, but dry, wet, and abraded treatments caused very highly significant differences. Very highly significant interactions were noted in fabric x treatment, fabrics x warp vs. filling, and in treatments x warp vs. filling.

To test the difference between specific fabrics, treatments, etc., the t-test was used on the arithmetic means given in Table 6. The differences in the means of breaking strength for proba-

bilities of .05, .01, and .001 used in the t-test are shown in Table 8.

Table 8. Differences in means of breaking strength of taffetas for probabilities.

Differences between	Probabilities .05	.01	.001
Fabrics (weighted silk, acetate and viscose)	1.92	2.57	3.37
Treatments (dry, wet, abraded)	1.92	2.57	3.37
Warp vs. filling	1.56	2.08	2.73

Table 9 shows the results of the t-test of the breaking strength of the three taffetas.

Table 9. Results of breaking strength of taffetas.

Source of variation	Differences	Significance
Fabrics (weighted silk, acetate, and viscose)	Weighted silk greater than acetate.	***
	Viscose greater than weighted silk or acetate.	***
Treatments (dry, wet, abraded)	Dry greater than wet or abraded.	***
	Abraded greater than wet.	**
Warp vs. filling	Warp greater than filling.	***

** highly significant
*** very highly significant

Similar statistical analyses were made for all groups of fabrics. Original breaking strength data for flat crepes is shown in Table 10 and for satin crepes in Table 11. Tables 12 and 13 show the results of analyses of data of breaking strength for flat crepes and satin crepes.

Table 10. Breaking strength of dry, wet, and abraded flat crepe samples of controls and after dry cleanings.

No. dry cleanings	Types of Material																							
	Pure dye silk flat crepe						Weighted silk flat crepe						Acetate flat crepe						Viscose flat crepe					
	Dry		Wet		Abraded		Dry		Wet		Abraded		Dry		Wet		Abraded		Dry		Wet		Abraded		
	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Means
0	44.2	21.0	22.6	16.2	26.9	12.5	44.5	14.7	23.9	8.7	17.6	8.9	40.0	26.9	27.9	19.8	31.6	19.3	32.3	31.8	9.8	12.0	7.6	9.0	22.1
1	45.9	20.9	31.5	14.7	21.7	15.8	43.0	13.4	23.2	8.4	29.5	9.0	40.9	28.0	26.5	18.1	33.3	22.5	30.5	32.6	8.9	11.0	13.6	14.5	23.2
5	44.6	26.6	27.2	14.7	20.7	14.3	42.5	12.2	26.7	6.0	21.5	8.4	40.4	29.3	25.2	15.4	32.4	22.4	29.5	31.6	7.5	10.5	11.1	12.5	22.2
10	38.2	24.4	23.2	13.5	17.4	12.0	37.0	14.5	19.4	6.0	14.1	9.2	41.2	31.7	25.2	16.8	33.0	20.9	31.3	31.6	8.5	10.8	11.1	12.4	21.0
	43.2	23.2	26.1	14.8	21.7	13.6	41.8	13.7	23.3	7.3	20.7	8.9	40.6	29.0	26.2	17.5	32.6	21.3	30.9	31.9	8.7	11.1	10.8	12.1	
Means	33.2		20.4		17.7		27.7		15.3		14.8		34.8		21.9		26.9		31.4		9.9		11.5		
			23.8						19.3						27.9						17.6				

Means		
	Dry	31.8
	Wet	16.9
	Abraded	17.7
	Warp	27.2
	Filling	17.0

Table 11. Breaking strength of dry, wet, and abraded satin crepe samples of controls, and after dry cleanings.

No. dry cleanings	Types of Material: Pure dye silk satin crepe — Dry Warp	Dry Filling	Wet Warp	Wet Filling	Abraded Warp	Abraded Filling	Weighted silk satin crepe — Dry Warp	Dry Filling	Wet Warp	Wet Filling	Abraded Warp	Abraded Filling	Acetate and viscose satin crepe — Dry Warp	Dry Filling	Wet Warp	Wet Filling	Abraded Warp	Abraded Filling	Means
0	112.3	33.1	75.9	29.1	81.4	35.1	70.1	20.5	31.7	16.0	22.4	5.1	50.7	18.9	32.6	8.9	36.4	4.2	38.0
1	115.4	30.4	55.8	22.1	79.8	26.9	81.3	19.5	37.3	15.8	21.8	6.9	49.6	15.6	24.2	6.6	34.1	9.4	36.2
5	122.0	34.7	83.3	24.6	82.4	28.0	78.9	16.3	36.7	13.4	36.1	4.2	51.4	17.8	27.9	5.4	39.2	5.4	39.3
10	121.6	33.8	76.0	24.2	84.7	29.1	70.6	20.6	39.0	15.1	20.3	13.4	50.1	16.9	29.3	5.5	27.2	16.8	38.6
	117.8	33.0	72.8	25.0	82.1	29.8	75.2	19.2	36.2	15.1	25.2	7.4	50.4	17.3	28.5	6.6	34.2	9.0	
Means	75.4		48.9		55.9		47.2		25.6		16.3		33.9		17.6		21.6		
			60.1						29.7						24.3				

Means		
	Dry	52.2
	Wet	30.7
	Abraded	31.3
	Warp	58.0
	Filling	18.0

Table 12. Results of analysis of breaking strength of flat crepes.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Fabrics (pure dye silk, wt.silk, acetate, and viscose)	3	1547.42	515.81	64.64***
Dry cleanings (0, 1, 5, 10)	3	61.05	20.35	2.55
Treatments (dry, wet, abraded)	2	4495.68	2247.84	281.68***
Warp vs. filling	1	2489.83	2489.83	312.00***
Fabrics x dry cleanings	9	58.14	6.46	
Fabrics x treatments	6	447.61	74.60	9.35***
Fabrics x warp vs. filling	3	1306.29	435.43	54.57***
Dry cleanings x treatments	6	37.73	6.29	
Dry cleanings x warp vs. filling	3	43.53	14.51	1.82
Treatments x warp vs. filling	2	245.43	122.72	15.38***
Error	57	454.76	7.98	
	95	11187.47		

*** very highly significant

Table 13. Results of analysis of breaking strength of satin crepes.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Fabrics (pure dye silk, wt. silk, acetate & viscose rayon)	2	17820.79	8910.40	271.44***
Dry cleanings (0,1,5,10)	3	92.01	30.67	
Treatments (dry, wet, abraded)	2	7193.66	2596.83	79.20***
Warp vs. filling	1	28808.00	28808.00	878.56***
Fabrics x dry cleanings	6	164.81	27.47	
Fabrics x treatments	4	1017.95	254.49	7.76***
Fabrics x warp vs. filling	2	4276.93	2138.47	65.22***
Dry cleanings x treatments	6	67.57	11.26	
Dry cleanings x warp vs. filling	3	171.41	57.14	1.74
Treatments x warp vs. filling	2	2918.48	1459.24	44.50***
Error	40	1311.43	32.79	
	71	63843.04		

*** very highly significant

The F-test showed that dry cleaning did not affect the breaking strength in either flat crepes or satin crepes, and there were again very highly significant differences in fabrics, treatments, warp vs. filling, and in interactions that did not involve dry cleaning.

Tables 14 and 15 show the differences in the means of breaking strengths of flat crepes and satin crepes for the probabilities of .05, .01, and .001 used in the t-test.

Table 14. Differences in means of breaking strength of flat crepes for probabilities.

Differences between	Probabilities .05	.01	.001
Fabrics (pure dye silk, wt.silk, acetate, & viscose rayon	1.62	2.15	2.80
Treatments (dry, wet, abraded)	1.42	1.89	2.46
Warp vs. filling	1.16	1.54	2.01

Table 15. Differences in means of breaking strength of satin crepes for probabilities.

Differences between	Probabilities .05	.01	.001
Fabrics (pure dye silk,wt. silk, acetate and viscose)	3.33	4.46	5.86
Treatments (dry, wet, abraded)	3.33	4.46	5.86
Warp and filling	2.75	3.67	4.83

Tables 16 and 17 show the results of the t-test on the breaking strength for the flat crepe and satin crepe groups.

Table 16. Results of t-test on breaking strength of flat crepes.

Source of variation	Differences	Significance
Fabrics (pure dye silk, weighted silk, acetate & viscose)	Pure dye silk greater than weighted silk or viscose.	***
	Acetate greater than pure dye silk, weighted silk or viscose.	***
	Weighted silk greater than viscose.	*
Treatments (dry, wet, abraded)	Dry greater than wet or abraded.	***
	No significant difference between wet and abraded.	
Warp and filling	Warp greater than filling.	***

* significant
*** very highly significant

Table 17. Results of t-test on breaking strength of satin crepes.

Source of variation	Differences	Significance
Fabrics (pure dye silk, weighted silk, acetate & viscose)	Pure dye silk greater than weighted silk or acetate and viscose.	***
	Weighted silk greater than acetate and viscose.	**
Treatments (dry, wet, and abraded)	Dry greater than wet or abraded.	***
	No significant difference between wet and abraded.	
Warp and filling	Warp greater than filling.	***

** highly significant
*** very highly significant

In all three groups of fabrics studied for breaking strength there were very highly significant differences among the fabrics, according to treatments, between warp and filling, and in all interactions not involving dry cleaning. No fabric was consistently highest in all groups. In regard to total breaking strength, viscose rayon was highest in the taffetas, acetate rayon in the flat crepes, and pure dye silk in the satin crepes. In the taffetas, dry and abraded breaking strengths were greatest for viscose rayon, and wet for weighted silk. In the flat crepes, dry and wet breaking strengths were similar for acetate rayon and pure dye silk, and abraded was highest for acetate rayon. In the satin crepes, pure dye silk was highest for dry, wet, and abraded breaking strength. As a group, the satin crepes had the greatest breaking strength and the flat crepes the lowest. In all groups dry breaking strength was greater than either wet or abraded, and in two of the three groups there was no significant difference between wet and abraded. In all cases warp breaking strength was greater than filling. Dry cleaning had no apparent effect upon any fabric in any group.

Elongation. Analysis of data was made for elongation in the same manner as for breaking strength. Original elongation data for taffetas is shown in Table 18, for flat crepes in Table 19, and for satin crepes in Table 20. Tables 21, 22, and 23, which follow, show the results of analysis of elongation data.

Table 18. Elongation of dry, wet, and abraded taffeta samples of controls, and after dry cleanings.

No. dry cleanings	Types of Material: Weighted silk taffeta						Acetate taffeta						Viscose taffeta						Means
	Dry		Wet		Abraded		Dry		Wet		Abraded		Dry		Wet		Abraded		
	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	
0	20.3	12.0	33.3	27.0	4.0	7.0	18.0	25.7	28.7	33.0	4.7	22.7	16.3	17.3	22.0	18.0	8.7	15.0	18.5
1	19.3	13.7	26.0	34.3	6.7	8.7	20.3	24.3	35.3	35.7	3.3	19.3	17.3	17.0	19.3	16.3	11.0	12.7	18.9
5	18.7	6.3	30.0	32.7	5.0	3.7	20.7	22.0	30.3	33.7	4.3	18.3	20.0	15.7	19.7	15.7	12.7	17.3	18.2
10	16.0	4.3	18.0	31.3	7.7	9.0	23.7	24.7	36.0	33.7	3.3	18.7	23.0	16.0	21.7	16.7	16.0	16.3	18.7
	18.6	9.1	26.8	31.3	5.8	7.1	20.7	24.2	32.6	34.0	3.9	19.8	19.2	16.5	20.7	16.7	12.1	15.3	
Means	13.8		29.1		6.5		22.4		20.8		11.8		17.8		18.7		13.7		
			16.5						22.5						16.7				

Means		
	Dry	18.0
	Wet	27.0
	Abraded	10.7
	Warp	17.8
	Filling	19.3

Table 19. Elongation of dry, wet, and abraded flat crepe samples of controls, and after dry cleanings.

No. dry cleanings	Types of Material: Pure dye silk flat crepe — Dry — Warp	Dry — Filling	Wet — Warp	Wet — Filling	Abraded — Warp	Abraded — Filling	Weighted silk flat crepe — Dry — Warp	Dry — Filling	Wet — Warp	Wet — Filling	Abraded — Warp	Abraded — Filling	Acetate flat crepe — Dry — Warp	Dry — Filling	Wet — Warp	Wet — Filling	Abraded — Warp	Abraded — Filling	Viscose flat crepe — Dry — Warp	Dry — Filling	Wet — Warp	Wet — Filling	Abraded — Warp	Abraded — Filling	Means
0	18.0	18.7	30.3	36.3	12.3	15.0	15.3	14.3	31.0	29.3	4.3	5.3	10.7	10.0	30.0	31.7	8.7	6.0	15.7	18.0	9.0	13.3	6.0	4.3	16.4
1	21.0	20.3	27.0	27.0	11.0	16.7	17.3	11.0	32.7	28.7	8.7	6.0	16.3	17.7	27.7	28.0	15.7	13.7	13.7	17.0	9.7	12.7	5.3	8.7	17.2
5	20.3	22.3	25.3	27.0	12.3	13.7	15.3	10.7	35.3	21.7	6.3	7.7	16.7	17.0	27.7	26.3	16.0	13.0	16.0	17.0	9.3	12.7	6.7	6.7	16.8
10	19.3	20.0	22.7	25.3	11.3	15.0	14.3	10.3	25.0	23.3	3.3	8.0	17.3	15.3	30.7	27.7	10.7	9.0	16.0	16.7	10.0	12.7	4.7	4.3	15.5
	19.6	20.3	26.3	28.9	11.7	15.1	15.6	11.6	31.0	25.8	5.6	6.8	15.2	15.0	29.0	28.4	12.8	10.4	15.4	17.2	9.5	12.8	5.7	6.0	
Means	20.0		27.6		13.4		13.6		28.4		6.2		15.1		28.7		11.6		16.3		11.2		5.8		
			20.3						16.0						18.5						11.1				

Means		
	Dry	16.2
	Wet	24.0
	Abraded	9.3
	Warp	16.5
	Filling	16.5

Table 20. Elongation of dry, wet, and abraded satin crepe samples of controls, and after dry cleanings.

No. dry cleanings	Types of Material																	
	Pure dye silk satin crepe						Weighted silk satin crepe						Acetate and viscose satin crepe					
	Dry		Wet		Abraded		Dry		Wet		Abraded		Dry		Wet		Abraded	
	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Means
0	17.7	20.7	31.7	36.3	15.7	22.3	9.3	10.0	22.7	33.7	3.7	8.0	23.0	20.7	30.7	30.0	14.0	5.7	19.8
1	19.3	20.7	32.7	28.7	13.0	18.3	13.7	8.3	23.3	27.7	3.7	8.7	23.3	17.7	34.7	21.0	11.7	14.0	18.9
5	19.3	21.0	30.0	28.3	12.7	31.3	10.3	9.0	27.0	25.7	5.3	6.3	22.3	17.7	37.7	15.0	17.7	7.7	19.1
10	19.3	19.0	29.3	27.3	11.0	19.3	9.0	9.0	26.0	30.0	3.3	10.7	29.7	21.0	41.0	17.7	12.0	27.0	20.1
	18.9	20.4	30.9	30.2	13.1	22.8	10.6	9.1	24.8	29.3	4.0	8.4	24.6	19.3	36.0	20.9	13.8	13.6	
Means	19.6		30.5		18.0		9.8		27.0		6.2		21.9		28.5		13.7		
	22.7						14.4						21.4						

Means	Dry	17.1
	Wet	28.7
	Abraded	12.6
	Warp	19.6
	Filling	19.3

Table 21. Results of analysis of elongation of taffetas.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Fabrics	2	561.44	280.72	21.40***
Dry cleanings	3	5.46	1.82	
Treatments	2	3216.96	1608.48	122.60***
Warp vs. filling	1	41.25	41.25	3.14
Fabrics x dry cleanings	6	77.77	12.96	
Fabrics x treatments	4	866.79	216.70	16.52***
Fabrics x warp vs. filling	2	264.37	132.19	10.08***
Dry cleanings x treatment	6	19.41	3.23	
Dry cleanings x warp vs. filling	3	18.04	6.01	
Treatments x warp vs. filling	2	286.57	143.29	10.92***
Error	40	524.69	13.12	
	71	3882.75		

*** very highly significant

Table 22. Results of analysis of elongation of flat crepes.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Fabrics	3	1154.78	384.93	88.69***
Dry cleanings	3	37.43	12.48	2.88*
Treatment	2	3464,98	1732.49	399.19***
Warp vs. filling	1	.10	.10	
Fabrics x dry cleanings	9	108.11	12.01	2.77**
Fabrics x treatments	6	1127.18	187.86	43.29***
Fabrics x warp vs. filling	3	100.17	33.39	7.69***
Dry cleanings x treatment	6	108.37	18.06	4.16**
Dry cleanings x warp vs. filling	3	10.57	3.52	
Treatment x warp vs. filling	2	4.39	2.20	
Error	57	247.25	4.34	
	95	6363.33		

*significant
**highly significant
***very highly significant

Table 23. Results of analysis of elongation of satin crepes.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Fabrics	2	967.28	438.64	27.22***
Dry cleanings	3	16.16	5.39	
Treatments	2	3288.67	1644.34	92.53***
Warp vs. filling	1	1.77	1.77	
Fabrics x dry cleanings	6	119.49	19.92	1.12
Fabrics x treatments	4	309.02	77.26	4.35**
Fabrics x warp vs. filling	2	391.27	195.64	11.01***
Dry cleanings x treatments	6	59.05	9.84	
Dry cleanings x warp vs. filling	3	46.86	15.62	
Treatments x warp vs. filling	2	231.54	115.77	6.51**
Error	40	710.76	17.77	
	71	6141.87		

** highly significant
*** very highly significant

Tables 24, 25, and 26 show the differences in means of elongation for the probabilities used in the t-test for taffetas, flat crepes, and satin crepes.

Table 24. Differences in means of elongation of taffetas for probabilities.

Differences between	Probabilities .05	.01	.001
Fabrics (weighted silk, acetate, and viscose)	2.12	2.84	3.73
Treatments (dry, wet, abraded)	2.12	2.84	3.73
Warp and filling	1.72	2.30	3.02

Table 25. Differences in means of elongation of flat crepes for probabilities.

Differences between	Probabilities .05	.01	.001
Fabrics (pure dye silk,weighted silk,acetate, viscose)	1.20	1.60	2.08
Dry cleanings (0, 1, 5, 10)	1.20	1.60	2.08
Treatments (dry, wet, abraded)	1.06	1.41	1.83
Warp and filling	.86	1.14	1.49

Table 26. Differences in means of elongation of satin crepes for probabilities.

Differences between	Probabilities .05	.01	.001
Fabrics (pure dye silk, weighted silk,acetate, viscose)	4.24	5.67	7.46
Treatments (dry, wet, abraded)	4.24	5.67	7.46
Warp and filling	2.00	2.67	3.51

Results of the t-test on the arithmetic mean of the specific fabrics, treatments, and warp filling are shown as follows: elongation of taffetas in Table 27, elongation of flat crepes in Table 28, and elongation of satin crepes in Table 29.

Table 27. Results of t-test for elongation of taffetas.

Source of variation	Differences	Significance
Fabrics (weighted silk, acetate, and viscose	Acetate greater than weighted silk or viscose.	***
	No significant difference between weighted silk and viscose.	
Treatments (dry, wet, and abraded)	Dry greater than abraded.	***
	Wet greater than dry or abraded.	***
Warp and filling	No significant difference.	

*** very highly significant

Table 28. Results of t-test for elongation of flat crepes.

Source of variation	Differences	Significance
Fabrics (pure dye silk, weighted silk, acetate & viscose)	Pure dye silk greater than weighted silk or viscose.	***
	Pure dye silk greater than acetate.	**
	Weighted silk greater than viscose.	***
	Acetate greater than weighted silk or viscose.	***
Dry cleanings (0, 1, 5, 10)	No significant difference between 0 and 1, 0 and 5, 0 and 10, or 1 and 5.	
	5 greater than 10.	*
	1 greater than 10.	**
Treatments (dry, wet, abraded)	Wet greater than dry or abraded.	***
	Dry greater than abraded.	***
Warp and filling	No significant difference.	

*significant
**highly significant
***very highly significant

Table 29. Results of t-test for elongation of satin crepes.

Source of variation	Differences	Significance
Fabrics (pure dye silk, weighted silk, and acetate and viscose)	Pure dye greater than weighted silk.	***
	No significant difference between pure dye silk and acetate and viscose.	
	Acetate and viscose greater than weighted silk.	***
Treatments (dry, wet, and abraded)	Wet greater than dry or abraded.	***
	Dry greater than abraded.	***
Warp and filling	No significant difference.	

*** very highly significant

The results of statistical analysis of elongation showed that very highly significant differences existed among various fabrics in all groups for treatments, and for fabrics x treatments interactions in two groups. There was no significant difference between warp and filling elongation in any group. Dry cleaning did affect significantly the elongation of fabrics in the flat crepe group. In the taffeta group acetate rayon had the greatest elongation. This was also true of pure dye silk in the flat crepe group. In the satin crepes there was no significant difference between pure dye silk and acetate and viscose mixed rayon; both were greater than weighted silk. In all groups total wet elongation was greater than either dry or abraded, and in all groups the abraded elongation was the lowest.

Shrinkage. Shrinkage for all fabrics was analyzed by the same method as for breaking strength and elongation except that all fabrics were placed in one table - Table 30 - and one analysis was made for all fabrics, as groups.

Table 31 shows the results of the analysis of shrinkage for all fabrics.

Table 31. Analysis of shrinkage data for all fabrics.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Fabrics (taffetas, flat crepes, satin crepes)	2	44.72	22.36	5.48**
Dry cleanings (1, 5, 10)	2	15.10	7.55	1.85
Warp vs. filling	1	10.84	10.84	2.66
Fabrics x dry cleanings	4	9.87	2.47	
Fabrics x warp vs. filling	2	11.87	5.94	1.45
Dry cleanings x warp vs. filling	2	.37	.19	
Error	46	187.46	4.08	
	59	280.23		

** highly significant

The t-test showed highly significant differences in fabrics but no significant differences for dry cleanings or warp and filling.

A t-test was made on the arithmetic means of the fabrics, as groups. Differences in the means of shrinkage for probabilities of .05, .01, and .001 are shown in Table 32.

Table 30. Shrinkage of dry, wet, and abraded samples of all fabrics after dry cleanings.

	Fabric	Warp & Filling	Dry Cleanings 1	5	10	Means		
Taffeta	Weighted silk	Warp	0.0	0.0	1.2	0.4	0.2	
		Filling	0.0	0.0	0.0	0.0		
	Acetate	Warp	0.0	0.6	1.2	0.6	0.3	.04
		Filling	0.0	0.0	0.0	0.0		
	Viscose	Warp	1.2	1.9	7.5	3.5	0.8	
		Filling	0.6	-2.5	-3.8	-1.9		
Flat crepe	Pure dye silk	Warp	2.5	2.5	2.5	2.5	1.8	
		Filling	1.2	0.6	1.2	1.0		
	Weighted silk	Warp	0.0	1.2	1.2	0.8	1.3	
		Filling	0.6	2.5	2.5	1.9		1.4
	Acetate	Warp	1.2	1.2	0.6	1.0	1.2	
		Filling	1.2	1.9	1.2	1.4		
	Viscose	Warp	1.2	3.8	2.5	2.5	1.4	
		Filling	0.6	-1.2	1.2	0.2		
Satin crepe	Pure dye silk	Warp	0.6	2.5	1.2	1.4	1.1	
		Filling	0.0	1.2	1.2	0.8		
	Weighted silk	Warp	0.0	1.2	1.2	0.8	1.7	2.7
		Filling	1.2	2.5	3.8	2.5		
	Acetate & viscose	Warp	6.9	2.5	7.5	5.6	5.2	
		Filling	1.9	2.5	10.0	4.8		
	Means		1.0	1.2	2.2			

Means	Warp	1.92
	Filling	1.07

Table 32. Differences in means of shrinkage of all fabrics for probabilities.

Differences between	Probabilities .05	.01	.001
Taffetas and flat crepes	1.27	1.69	2.21
Flat crepes and satin crepes	1.27	1.69	2.21
Taffetas and satin crepes	1.37	1.82	2.38

The results of the t-test for shrinkage of all fabrics is shown in Table 33.

Table 33. Results of t-test for shrinkage of all fabrics.

Source of variation	Differences	Significance
Taffetas and flat crepes	No significant difference.	
Taffetas and satin crepes	Satin crepes greater than taffetas.	**
Flat crepes and satin crepes	Satin crepes greater than flat crepes.	*

* significant
** highly significant

Satin crepes shrank most and taffetas least of the groups of fabrics studied. In each group, results were as follows: taffetas, - viscose rayon shrank most and weighted silk least; flat crepes, - pure dye silk shrank most, viscose rayon next, and acetate rayon least; satin crepes, - acetate and viscose rayon mixed shrank most and pure dye silk least.

SUMMARY

A study of the serviceability of taffeta, flat crepe, and satin crepe dress fabrics of all silk and all rayon, both before and after dry cleaning, gave the following results.

1. Fabrics of different types reacted differently to the same tests, even though they were made of the same fiber.

2. Breaking strength of viscose rayon was the greatest of the taffetas by a very highly significant amount. The same was true of acetate rayon in the flat crepes, and pure dye silk in the satin crepes.

3. Satin crepes, as a group, had the highest breaking strength, and flat crepes the lowest.

4. In elongation, acetate rayon was greatest in the taffetas by a very highly significant amount. Pure dye silk in the flat crepe group was greater than acetate rayon by a highly significant difference, and was greater than viscose rayon and weighted silk by very highly significant amounts. In the satin crepes there was no significant difference between pure dye silk and acetate and viscose mixed rayon, but both were greater than weighted silk by a very highly significant amount.

5. In shrinkage, there was no significant difference between the taffetas and the flat crepes. The satin crepes were significantly greater than the flat crepes, and were greater than the taffetas by a very highly significant amount.

6. Warp breaking strength was greater than filling breaking strength by a very highly significant amount, but there was no significant difference between warp and filling in either elongation or shrinkage.

7. Dry cleaning had no effect upon the breaking strength in any group, but affected elongation in one group, and shrinkage in all groups.

8. There was no slippage of any fabric in either warp or filling direction.

9. The all silk fabrics of the types studied did not prove superior to those of all rayon.

ACKNOWLEDGMENT

The writer wishes to express her sincere appreciation to Dr. Hazel Fletcher, Assistant Professor of Clothing and Textiles, for directing this study, and to Mrs. Katharine Hess, who gave valuable suggestions.

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