THE PHYSICAL PROPERTIES OF SELECTED CURTAIN FABRICS MADE FROM SYNTHETIC FIBERS

by

Fay Chandler Honeycutt

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Pauline E. Keeney
Pauline E. Keeney, Adviser

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CHAPTER I

INTRODUCTION

Within the past ten years man-made fibers have been used extensively in the production of fabrics for home furnishings. Research has produced fibers with properties that excel those of natural fibers. Such properties as increased tensile strength, dimensional stability, wrinkle recovery and ease of care, that are desirable qualities in sheer glass curtain fabrics, have made synthetic fibers extremely popular for use in window decoration.

The rapid discovery of the various man-made fibers and presentation of sheer fabrics of various constructions have presented many problems to the consumer. The consumer is faced with the problems of knowing what fabrics are available, how the fabrics will perform, and what procedures are best for the care of them. Since there is a dearth of information based on unbiased research in this field, the consumer must rely on the advertising of the manufacturer, which gives only the advantageous points, or on costly personal experience with the fabrics.

This study was planned to determine, through laboratory analysis and testing, any similarities or differences in (1) the construction of and (2) the performance features of curtain fabrics of synthetic fibers. The study further proposed to determine the best method for cleaning the selected fabrics.

So rapidly does textile technology develop new fibers and evolve means to modify and improve others, that the fabric picture changes constantly. A basic understanding of synthetic fibers and their application is essential to intelligent selection and care of curtain fabrics. The average consumer needs information about the performance features of available fabrics. A compilation of results of actual laboratory tests should aid the consumer in buying and caring for the available varieties of sheer curtain fabrics.

According to reports of representatives from individual research laboratories, textiles technicians actually custom-design a fabric for its end-use and build in desired qualities.[1] Therefore, all fabrics of similar fiber content cannot be expected to be similar in construction or serviceability. No attempt was made in this study to conclude that all fabrics of similar construction and fiber content would perform similarly. Since all fabrics of all fibers could not be included, a sampling of fabrics was purchased for the study from yard goods counters in local department stores and interior decorator shops. This provided a varied selection of fabrics that were available to consumers in the vicinity of Greensboro.

The testing techniques for the laboratory analysis of the fabrics were limited to those procedures which would determine fabric construction characteristics and performance features that would (1) be essential for long wear as glass curtains and (2) be affected by laundering and dry cleaning procedures.

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[1] A. Stanley Kramer, "Man-Made Fibers and Their Place in Today's Fabric World," What's New in Home Economics, (January, 1954), p. 35.

The remainder of the study is divided into four parts. Chapter II, a Review of Literature, presents published information about the current trends in window treatment, the physical properties and performance features of the selected synthetic fibers, and the adaptability of these fibers to use in curtain fabrics. Chapter III describes the procedure for the selection of the curtain fabrics, and the procedures for laboratory analysis of (1) fabric construction and (2) serviceability features. Chapter IV is the compilation and interpretation of data pertaining to (1) the selection of the fabrics, and (2) the laboratory analysis and testing of fabric construction that would indicate their serviceability in use. Chapter V includes the summary, conclusions and recommendations for further study.

CHAPTER II

REVIEW OF LITERATURE

Current Trends in Window Curtaining

Faulkner lists the three functions of a window as (1) provision of ventilation, (2) transmission of light and (3) provision of views.[1] He further states that window treatment should not hamper the fulfillment of these functions. Curtains should be used for attaining privacy, controlling the amount and kind of light and air entering the home, as well as for satisfaction of the aesthetic senses.[2]

The current trends consist of more informal window treatment and of larger window areas. With the introduction of the spacious picture and window wall type windows, and the revival of the bay window, the trend toward heavy and ornate decor has changed to a trend of curtaining that, with a minimum amount of yardage and expense, gives a maximum amount of control of light, privacy, ventilation, and views.[3] The requirements for increased yardage and exposure to the ravages of sun, moisture and moth have necessitated the production of fabrics that are durable, easily maintained and resistant to such elements that cause degradation.[4]

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1 Ray Faulkner, Inside Today's Home, (New York: Henry Holt and Company, Inc., 1954), p. 315.

2 Ibid., p. 327.

3 Hazel M. Fletcher and S. Helen Roberts, "Predicting the Wear Life of Sheer Curtaining Material," The Journal of Home Economics, Vol. 4, (May, 1954), pp. 318-319.

4 Faulkner, loc. cit.,

Glass curtains have been found to fulfill all of the functions of curtaining. Faulkner defines glass curtains as:

> ...curtains...of thin materials that hang next to the glass, soften and diffuse light, reduce glare and sharp contrasts of dark shadows cast by furniture.[5]

Glass curtains soften the brittle appearance of glass and give partial privacy without obstruction of view.[6]

The glass curtains of former times were usually of ornate lace construction or loosely woven scrims, fish nets or organdies of cotton fiber that deteriorated with prolonged exposure to light, moisture and heat. This type of window treatment required a great deal of maintenance and did not remain crisp long after cleaning.

Rockow states that informal sill or apron length curtains of sheer and semi-sheer casement cloth in plain, textured or nubby effects are currently popular.[7] Faulkner says that any thin fabric that drapes well and hangs well is suitable for use, and those that withstand sun and washing or cleaning are more desirable.[8] He further mentions that the common fabrics used for glass curtains are wiry marquisettes, refined sleek rayon ninon, fish nets, gauzes and bobbinets of either natural fibers or of man-made fibers such as rayon, nylon and Fiberglas.[9]

Synthetic fibers are rising in preference for curtain fabrics over

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5 Ibid., p. 331.

6 Ibid.

7 Hazel Kory and Julius Rockow, Creative Home Decorating, (New York: H. S. Stuttman Company, 1953), p. 394.

8 Faulkner, op. cit., p. 327.

9 Ibid., p. 332.

the natural fibers. Levine's study of the preferences of two thousand, seven hundred and nine homemakers in 1957 revealed that although the majority or sixty-four percent possessed cotton curtains, a great percentage of the consumers were "becoming aware of and might be interested in experimenting with newer synthetic fibers."[10] Only two percent owned Fiberglas window treatment but nine percent chose it as the preferred fiber for their next purchase.[11] Nylon and Dacron were preferred by five percent but were owned by only one percent.[12] Rayon, rayon mixtures, and plastic draperies were preferred by about half as many as owned them.[13]

Synthetic Fibers, Their Properties and Care

Synthetics first appeared in the form of rayons--nitro-cellulose, viscose, Bemberg and cellulose acetate.[14] New fibers and fabrics, however, are being produced constantly through chemically changing spinning solutions, varying the construction of yarns and fabrics, and the after treatments and finishes. These changes have been brought about in an effort to overcome weaknesses in features of performance as well as to reduce cost and time spent in maintenance.[15]

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10 Daniel B. Levine, "Homemakers Appraise Fibers for Selected Household Furnishings", (A Preliminary Summary Report), (Washington: U. S. Department of Agriculture, Marketing Research Division, January, 1958), p. 3.

11 Ibid.

12 Ibid., p. 4.

13 Ibid.

14 Rockow, op. cit., p. 147.

15 "Modern Fibers and Fabrics," (New York: Customer Services Department, J. C. Penney Company, Ltd., 1956), p. 5.

Some representative synthetics adapted for end use as curtain fabrics are viscose, acetate, Dacron, nylon, Arnel, Fortisan and Fiberglas. The following description is given of synthetic fibers:

> Synthetic fibers are fibers built up from nonfibrous raw materials and have a common origin (with natural fibers) because they consist of the same elementary chemical "building blocks": carbon...hydrogen...oxygen... nitrogen...and sometimes sulfur...and chlorine... The manner in which these elements are chemically combined determines the nature of the resulting fiber...[16]

> The general procedure for producing synthetic fibers is to:

> ...transform the material into a thick viscous liquid and force it through a spinneret to form a fiber... The viscous liquid called "dope" is forced through these almost invisible holes into a chamber of air or into a chemical hardening bath... When the filaments are hardened, they are stretched and twisted together to form continous filament yarn... A stream of filaments can be cut into short lengths called staple either for blending with other fibers or for spinning directly into yarns...[17]

Production of Rayon. Rayon was the first regenerated cellulosic fiber produced for commercial use and called "artificial silk" until 1924 when it became known as rayon.[18] Viscose is produced by combining alkali cellulose with carbon disulfide in the xanthation process, filtering, aging, forcing through a spinneret and coagulating.[19] Because of its use in varied novelty textured fabrics, viscose filaments are cut into staple and either blended or spun.

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16 Ibid., p. 4.

17 Ibid.

18 L. E. Parsons and John K. Stearns, Textile Fibers, (International Textbook Company, 1951, Part III), p. 4.

19 Katherine P. Hess, Textile Fibers and Their Uses, (New York: J. B. Lippincott Company, 1948), pp. 349-351.

Properties of Rayon. The rayon fiber has few good properties that make it a serviceable curtain fabric. It has a smooth surface and wiry texture.[20] The numerous undesirable properties that have caused rayon to lose popularity in the curtain fabric industry are (1) tendency to stretch or sag due to rapid absorption of moisture, (2) tendency to stretch or shrink after laundering or cleaning unless stabilized carefully during the finishing process, (3) slow wrinkle recovery, (4) prolonged drying time and (5) loss of half its strength when wet.[21]

Care of Rayon Fibers. Rayon fibers of machine washable types may be laundered as cotton but shrinkage is progressive in some resin treated fabrics.[22] Rayon is completely drycleanable but relaxation shrinkage occurs unless the fabric is resin treated.[23]

Production of Acetate. Acetate is the name given to a fiber, yarn, or fabric made by the cellulose acetate process and differing from rayon in that it is an ester of cellulose rather than regenerated cellulose.[24] The fiber was introduced to the American public in 1919 as the most costly of all textile fabrics, whereas, today it is the least expensive and fastest growing of the man-made fibers.[25]

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20 "Modern Fibers and Fabrics", op. cit., p. 6.

21 Albert E. Johnson, "Table of Fiber Properties", Man-made Textile Encyclopedia (1st ed.), I, 750-751.

22 Ibid.

23 Ibid.

24 "The List of Man-Made Fibers is Growing" (New York: Educational Bureau of Coats & Clark, Incorporated). (Mimeographed Reprint from Women's Wear Daily) p. 4.

25 "Modern Fibers and Fabrics," op. cit., p. 8.

Production of acetate involves steeping cellulose in an acetic anhydride in the presence of a sulfuric acid catalyst to produce cellulose acetate.[26] After aging and rinsing away of the acetic acid, the cellulose acetate flakes are dissolved in acetone, blended and spun by forcing the liquid through spinnerets to produce filaments.[27]

Properties of Acetate. The desirable properties of acetate are (1) resistance to moisture and wrinkling, (2) good draping ability, (3) soft and silky texture and (4) ease with which it blends with other fibers.[28] The less desirable properties are (1) loss of strength when wet, although stronger than rayon, (2) sensitivity to heat (3) slowness of drying, and (4) low resistance to sunlight of untreated delustered yarns.[29]

Care of Acetate Fibers. Acetate is washable by hand or in a home laundering machine at low temperature using gentle action and neutral soaps or detergents.[30] Extraction sets wrinkles.[31] Acetate is drycleanable and is not affected by cleaning solutions.[32]

Production of Nylon. Nylon, the first true synthetic polyamide

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26 Charles L. Fletcher, "Cellulose Acetate," Man-Made Textile Encyclopedia (1st ed.), pp. 17-18.

27 "Modern Fibers and Fabrics", op. cit., p. 9.

28 Ibid.

29 Johnson, op. cit., p. 751.

30 Ibid.

31 Ibid.

32 Ibid.

was an outgrowth of research begun in 1928 by the DuPont Company.[33] The crystalline structure is attributed to the orientation of molecules in the drawing process which can be altered and controlled to produce varied properties.[34]

Properties of Nylon. Nylon has been identified as the strongest of the synthetic fibers. This strength makes it possible to produce very sheer but strong fabrics.[35] Other favorable properties are (1) the elasticity that enables fabrics to retain their shape, (2) resistance to heat (it melts at 480° F), (3) resistance to wrinkling, and (4) dimensional stability.[36]

Undesirable qualities are (1) discoloration with laundering due to its affinity for bleeding dyestuffs, and redeposition of soil, (3) weakening in the presence of chlorine bleaches, (4) degradation by action of light, (5) affinity for oily and air-borne soils, and (6) yellowing with age.[37]

Care of Nylon Fibers. Nylon can be washed by hand or machine at warm temperature up to 160° F. drip dried or tumbled cold after a short

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[33] A. S. T. M. Committee D-13 on Textile Materials, A. S. T. M. Standards on Textile Materials, (Abstract from paper presented at the October, 1940, meeting of Committee D-13), p. 351.

[34] Ibid.

[35] Frank J. Soday, "Polyamide Fibers," Man-Made Textile Encyclopedia (1st ed.), I, p. 115.

[36] Mauresberger, loc. cit.

[37] Johnson, op. cit., pp. 752-753.

extraction period.[38] Nylon fibers are completely drycleanable and not affected by solvents.[39]

Production of Dacron. Dacron was discovered in the 1930's by Dr. Wallace Carothers of DuPont but was produced first in England by British chemists and called "Terylene". The fiber is a product of polyester condensation.[40] The fiber is formed by combining dimethyl terephthalate and ethylene glycol to form a polyester, followed by filtration of the substance and spinning into filament form. The filaments may be cut into short fibers, crimped and spun or blended with other fibers.[41] The fibers may be heat-set at 480° F. to prevent dimensional change.[42]

Properties of Dacron. Desirable characteristics of the Dacron fiber are (1) resilience (2) wrinkle resistance, (3) retention of shape, (4) resistance to chemicals, (5) resistance to sunlight, (6) high tensile strength, (7) retention of high tensile strength even when wet, and (8) ability to dry quickly.[43]

Undesirable characteristics of the Dacron are (1) discoloration

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38 Ibid.

39 Ibid.

40 "Fibers by DuPont," (Delaware: Product information Section Textile Fibers Department, E. I. duPont de Nemours and Co., Inc.), p. 10. (Mimeographed)

41 Ibid.

42 J. B. Quig and R. W. Dennison, "Functional Properties of Synthetics," Industrial and Engineering Chemistry, XXXXIV, (September, 1952), p. 117.

43 J. F. de Bordenave, "Polyester Fibers", Man-Made Textile Encyclopedia (1st ed.) I, pp. 117-118.

from static attracted air borne soil, and (2) discoloration from high temperature.[44]

Care of Dacron Fibers. Dacron can be laundered by hand or machine on slow cycle and low extraction. The fabrics may be tumbled dry due to the dimensional stability of the fiber.[45] The fiber resists and is not responsive to bleaches. Dacron is completely drycleanable.[46]

Production of Fortisan. Fortisan, the high tenacity saponified rayon fiber produced by Celanese Corporation of America, was first used during World War II by the United States for equipment that demanded low specific gravity, great strength and stability.[47]

Fortisan, a highly oriented cellulose is prepared by

> ...completely saponifying cellulose Acetate under high tensions. The acetate is subjected to mechanical treatment to obtain a parallel molecular structure. It is then saponified (acid molecules are split off)... by many methods such as the employment of caustic soda or organic bases.[48]

Properties of Fortisan. Fabrics made from Fortisan are not thermoplastic. The good qualities of the fiber are: (1) good heat resistance, (2) resistance to steam, (3) resistance to dimensional change during laundering and drycleaning, (4) a high resistance to sunlight, and

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44 Ibid., p. 119-120.

45 Johnson, op. cit., pp. 752-753.

46 Ibid.

47 Jesse L. Riley, "Acetate and Fortisan", Man-Made Textile Encyclopedia, (1st ed.) I, pp. 67-68.

48 Leonard Mauer and Harry Wechsler, "Man-Made Fibers", (New York: Rayon Publishing Company, 1953) p. 4.

(5) exceptional strength in sheer fabrics. The undesirable properties of Fortisan are (1) low wrinkle resistance, (2) low resistance to sunlight, and (3) low resistance to mildew, moth and fungi.[49]

Care of Fortisan Fibers. Fortisan should be laundered only when recommended. The fibers are not damaged by bleach. Fortisan is completely drycleanable as rayon.[50]

Production of Arnel. Arnel, a triacetate, differs from regular diacetate in that three acetylation processes are necessary to produce the fiber, rather than the usual two processes.[51]

Properties of Arnel. The fiber is produced by the Celanese Corporation of America, and although not strong as compared with other synthetics, possesses the good qualities of acetate and a high resistance to heat.[52] The fiber is not found in very sheer fabrics that must withstand prolonged wear.[53]

Care of Arnel Fibers. Arnel has good launderability at all temperature levels depending on dyestuffs and finish qualities present.[54] The

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49 W. E. Coughlin, "What We Can Expect From Our Newer Synthetic Fibers," The Journal of Home Economics, Vol. 49, (October, 1957), p. 637.

50 Albert E. Johnson, "Table of Fiber Properties", Man-Made Textile Encyclopedia, (1st ed.) I, pp. 750-751.

51 "The List of Man-Made Fibers is Growing, (New York: Educational Bureau of Coats and Clark, Incorporated), (Mimeographed reprint from Woman's Wear Daily, April 17, 1956).

52 W. E. Coughlin, "What We Can Expect From Our Newer Synthetic Fabrics", Journal of Home Economics, Vol. 49, No. 8, (October 1957), pp. 636-637.

53 Ibid.

54 Johnson, op. cit., p. 752-753.

fiber can be bleached and can be ironed at high temperatures without shine or glaze. The fiber is completely drycleanable.[55]

Production of Fiberglas. Fiberglas is a product of the Owens-Corning Fiberglas Corporation and constructed of such raw materials as sand, limestone, and other mineral ingredients melted at 2500° F. and spun into filament form.[56] Resin treatment of the fiber protects the fiber and is bonded to it at 350-400° F., thereby setting up a chemical reaction.[57]

Properties of Fiberglas. Desirable properties of Fiberglas are (1) dimensional stability, (2) excellent light control through inherent translucence of the yarn, (3) perfect washability with no ironing, and (4) permanent fresh appearance.[58] Properties that are undesirable are (1) low abrasion point, (2) tendency to "gray" and (3) low resistance to bleaches.[59]

Care of Fiberglas Fibers. Fiberglas fabrics are hand washable only, cannot be squeezed, rubbed or wrung. The fabrics may be ironed at high temperatures.[60] The fiber is responsive to bleach. Drycleaning is not recommended due to breakage and slippage of yarns.[61]

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55 Ibid.

56 Richard P. Deacon, "What We Can Expect From Our Newer Synthetic Fabrics", Journal of Home Economics, Vol. 49, No. 8, (October, 1957), p. 638.

57 Ibid., p. 639

58 Ibid.

59 Ibid.

60 Johnson, loc. cit.

61 Ibid.

Other Related Studies

Little study has been done in the field of testing the performance of selected curtain fabrics. Stevens and Richey conducted research on the weathering of marquisettes in Florida climate to prove that one of the qualities a fiber needs in order to be used successfully is resistance to degradation by weather.[62] Thirteen fabrics were weathered outdoors and in storage on the Gulf Coast and inland forty miles. One set of fabrics was stored for six months; one set exposed three months in the spring and one set exposed three months in the fall. Their findings were as follows:

1. No appreciable difference in degradation due to locale in the storage set of fabrics.

2. No appreciable difference in degradation due to locale in sets exposed outdoors.

3. Retention of appreciable strength in acrylics exposed outdoors six months.

4. Greater degradation in spring than fall.

5. Low retention of strength of viscose and acetate in spring--others, 14-40 percent of original strength.

6. In fall season low retention of strength of viscose and acetate, 25 and 18 percent--others, 32-48 percent, except acrylics with 70 percent strength retention.[63]

Leonard investigated the performance characteristics of draperies and curtains used in representative homes of Texas.[64] She conducted a

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[62] Hazel T. Stevens, Helen L. Richey, Marquerite Reeves, "Weathering of Marquisettes," Journal of Home Economics, Vol. 51 (March, 1959), pp. 182-186.

[63] Ibid., p. 184-186.

[64] Lucy Leonard, "A Technological Study of Drapery and Curtain Textile Fabrics," Journal of Home Economics, Vol. 51 (March 1959), p. 222.

survey of two hundred homes and recorded data about the type of curtaining used as to (1) style, (2) fiber content, (3) utilization of color, (4) performance, (5) condition of service, (6) direction of exposure, (7) types of air conditioning and heating used, and (8) length of time used.

Cormany's study evaluated some of the service qualities of selected sheer curtain fabrics currently on the market.[65]

> ...to compare the effect of light on fabrics after exposure to the carbon arc of the FDA-R Fade-Ometer with that produced by natural light through glass; and to evaluate the Fade-Ometer as a means of predicting the serviceability of curtain fabrics.[66]

The fabrics used were analyzed for (1) thread count, (2) breaking strength, (3) weight per square yard, (4) type and twist of yarn, and (5) dimensional change.[67]

The results of her study indicated that:

1. Sheer curtain fabrics made of cellulose fibers tend to be less satisfactory when subjected to light and laundering than are fabrics made of the resin or glass fibers.

2. The Fade-Ometer can be used to reveal the trend related to the effect of sunlight on fabric strength.

3. Wet breaking strength of the fabrics was less after each six months exposure to natural light and each fifty hours exposure in the Fade-Ometer.

4. The cotton and man-made cellulose fibers, except acetate, maintained considerable strength after three hundred hours exposure in the Fade-Ometer.

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65 Esther M. Cormany, "Service Qualities of Sheer Curtain Fabrics," Journal of Home Economics, Vol. 51, No. 10, (December, 1959) pp. 871-874.

66 Ibid., p. 871.

67 Ibid.

5. Wet breaking strength of the nylon fabric was affected more than that of any of the other resin fibers by exposure to natural light.

6. The breaking strength of the Orlon and Dacron fabrics was affected little by exposure to either sources of light.

7. The Fiberglas fabrics showed little difference in wet strength after three years exposure to natural light or three hundred hours exposure in the Fade-Ometer.[68]

[68] Ibid., pp. 872-874.

CHAPTER III

METHOD OF PROCEDURE

I. PROCEDURE FOR THE SELECTION OF FABRICS

The ten fabrics to be included in this study were synthetic fabrics and fabrics constructed of blends of synthetic fibers with cotton fibers available at yard goods counters for use in the construction of glass curtains.

The fabrics to be studied were purchased from local retail stores and decorating shops, and were representative of fabrics available to the consumer in the local community. Because of the variations in the construction and weight of available curtain materials, suitability according to weight and construction for use as glass curtains was the main factor considered in selection of the fabrics. The fabrics selected were catagorized as marquisettes, ninons, and novelty fabrics.

II. PROCEDURE FOR LABORATORY ANALYSIS OF FABRIC CONSTRUCTION

Thread Count. The test method used to determine the number of warp and filling yarns per linear inch was that recommended by the American Society for Testing Materials.[1]

Using the Suter counter, five counts were taken in the warp

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[1] American Society for Testing Materials Committee D-13 on Textile Materials, American Society for Testing Materials Standards on Textile Materials (Philadelphia: American Society for Testing Materials, 1957), pp. 171-172.

direction with no two yarns being counted more than once and no count taken nearer the selvage than one tenth the width of the fabric. The average of the five counts was reported as the number of warp yarns per linear inch.

The number of filling yarns per linear inch was counted and calculated in the same manner.

Weave. The weaves were determined by visual examination using a magnifying pick glass and a microscope.

Weight per Square Yard. The procedure used to determine weight per square yard was that established by Skinkle.[2]

Five samples, two inches square, were cut from each of the fabrics. The oven-dried samples were weighed on an analytical balance, and the weights recorded. The weight per square yard was calculated by the formula $S = \frac{36 \times 36}{A} \times \frac{G}{28.35}$ for each sample. In the formula S is the ounces per square yard; A is the area of the sample in square inches; and G is the average oven-dry clean weight of the sample. The mean weight obtained was recorded as the weight per square yard.

Fiber Content. The fiber content stated by the fabric supplier was verified and the percentage of fiber content was verified and determined in the laboratory according to the method recommended by the American Association of Textile Chemists and Colorists.[3]

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[2] John Skinkle, Textile Testing (New York: Chemical Publishing Company, 1949), pp. 78-79.

[3] American Association of Textile Chemists and Colorists, 1959 Technical Manual and Yearbook of the American Association of Textile Chemists and Colorists (New York: Howe Publishing Company, 1959), Volume XXXV, pp. 56-59.

The oven-dried clean weight of the fabric samples, two inches square was obtained. The samples were treated with chemicals to identify the fibers present and to remove any cotton, rayon or acetate present in the blended and combination fabrics. After thorough washing and neutralizing, the samples were again oven-dried and weighed.

The percentage of synthetic fiber in the blended and combination fabrics was calculated using the formula $\frac{B}{A} \times 100$, with B as the oven-dried weight of the synthetic after the cotton, rayon, or acetate was removed, and A as the oven-dried weight (clean weight) of the sample. The percentage of cotton, rayon or acetate content was determined by subtracting the percentage of synthetic fiber from one hundred. Five samples were tested in this manner and averaged to give the mean fiber content.

Twist. The number of spiral turns per linear inch given to the yarns were determined by the test methods established by Skinkle.[4]

The gage length was set at ten inches, and the indicator set at zero. A single warp yarn was ravelled from the fabric to allow enough thread to be clamped in the two jaws. The rotating jaw was revolved until all twist was gone from the ten inches of yarn. This point was reached when a pick needle was passed along the parallel strands of fibers or yarns from one jaw to the other. The dial was read and the number of turns was recorded.

This procedure was followed for ten warp yarns, and the turns per inch were calculated using the following formula: $T.P.I. = \frac{N}{L}$. In the

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[4] Skinkle, op. cit., pp. 58, 64-65.

formula, N is the mean number of turns necessary to untwist a yarn; L is the gage length of 10 inches.

The same procedure was used for determining the twist in a ply yarn. A yarn was placed in the twist counter in the same manner used for single yarns. The rotating jaw was revolved until all the twist was removed from one ply. The amount of twist was recorded. The untwisted ply yarn was broken away at the jaws and the procedure repeated for each remaining ply of the yarn.

Fabric Thickness. The compressometer-type thickness gage was used for determining fabric thickness. The tests were those specified as standard by the American Society for Testing Materials Committee D-13.[5]

The fabric, smoothed and free of wrinkles was placed upon the anvil of the gage without tension. The presser foot was lowered onto the fabric without impact. Five readings were taken in this manner over the surface; and none were taken closer to the selvages than one-tenth of the width of the fabric. The five readings were averaged and the mean recorded as the fabric thickness.

Denier. The denier, which represents the number of units of length in a unit of weight of the filament yarn, was calculated using the Universal Yarn Numbering Balance according to the recommendations supplied with the instrument.[6]

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5 American Society for Testing Materials Committee D-13 on Textile Materials, op. cit., p. 171.

6 Roller-Smith Precision Balance, Alfred Suter, Universal Yarn Numbering Balance, Instruction sheet.

The procedure was based on the silk and rayon system with lengths of yarn measuring 90 centimeters.

Ten readings were taken, averaged, and the mean recorded for both warp and filling yarns.

Filament Count. The procedure for determining the filament count was based on recommendations by Skinkle.[7]

A yarn was removed from the fabric and untwisted at the cut end as much as needed to form a fan shaped arrangement of filaments. The untwisted filaments were mounted and counted microscopically. The filament count was determined by averaging five counts.

Staple Length. The procedure for determining the staple length was based upon the procedure for hand stapling recommended by Skinkle.[8]

A warp yarn was removed from the material and untwisted. Several fibers were removed from the yarn and placed upon a slightly oiled rule. A single fiber was drawn out and laid on the scale of the rule. The length was measured and recorded to the nearest tenth of an inch. The mean of five measurements taken in this manner was recorded as the final staple length.

The same procedure was used to determine the average filling staple length.

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[7] Skinkle, op. cit., p. 55.

[8] Ibid., p. 35.

III. PROCEDURES FOR LABORATORY ANALYSIS OF FABRIC SERVICEABILITY

Tests to determine dimensional change, tensile strength, crease resistance and light reflectance, were used to indicate the serviceability of the fabrics.

The prediction of serviceability in consumer use was determined by tests made after the fabric had been laundered and dry cleaned. The series of testing was performed on the original fabric, the fabric following the first dry cleaning and laundering and following the fifth dry cleaning and laundering.

Preparation of Fabrics for Testing. For each fabric tested, four swatches measuring fifteen inches square were cut from each yardage of fabric. A ten inch square, following the warp and filling threads, was marked in each swatch with indelible laundry and dry cleaning marking pencils. In this way each square might be measured periodically for dimensional change. After the determination of dimensional change and light reflectance percentage, these swatches were cut for use in determining tensile strength and crease resistance.

Laundering Procedure. The procedure for laundering used was that recommended by the American Association of Textile Chemists and Colorists for testing fabrics other than cotton and linen.[9]

The laundering tests were done in a cylindrical reversing wash wheel under controlled conditions. The specimens to be tested, plus

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9 American Association of Textile Chemists and Colorist, op. cit., pp. 133-134.

additional cloth to approximate an eight pound load, were laundered five times. The washer was flushed with water before using the following washing procedure:

1. Fifteen minute sudsing at 120° F. with neutral soap of the type manufactured for home laundering.

2. Three fifteen-minute rinses at 100° F.

The test swatches were placed in the extractor for one minute. Following extraction, the fabrics were pressed on a flat bed press for six seconds at low temperature.

Dimensional Change. The ten inch square marked on the first test swatch was measured after the first laundering and the ten inch square on the second test swatch was measured after the fifth laundering to determine dimensional changes. The pressed fabric was laid on a flat surface without tension. Five measurements were taken uniformly over the square in both the warp and filling directions. The measurements were recorded to the nearest hundredth of an inch.

The measurements were averaged and the percentage of the dimensional change determined using the following formula: $\frac{A-B}{A} \times 100 = C$. In the formula, A is the original warp measurement, B is the warp measurement after laundering, and C is the percentage of dimensional change.

Dry Cleaning Procedure. Two swatches of each fabric were prepared for dry cleaning tests in the same manner as for laundering tests.

The swatches, plus additional garments to approximate a twenty-seven pound load were cleaned in an automatic dry cleaning machine using a synthetic solvent and 200 CC. of a concentrated liquid dry cleaning soap.

The swatches were pressed on a steam press for six seconds at low temperature.

The same procedure used for determining dimensional change following the first and fifth launderings, was used to determine dimensional change following the first and fifth dry cleanings.

Breaking Strength. The raveled strip method and the pendulum type testing machine specified by the American Society for Testing Materials Committee D-13 were used in determining dry and wet tensile strengh.[10]

The tests were performed on five dry specimens and five wet in both the warp and filling directions. These tests were run on the original fabric and on the test swatches after the first and fifth launderings and dry cleanings. All tests for dry strength were performed on specimens conditioned at 65 $\pm$ 2% r.h., 70 $\pm$ 2° F. for at least eight hours. Test specimens to determine wet tearing strength were immersed in tap water for two hours before testing.

Five specimens in the warp and filling directions were cut one and one-fourth inches wide by six inches long. The strip was then raveled to one inch in width by removing approximately the same number of yarns from each side.

Tests were performed according to the procedure for the raveled strip method and readings taken on the dial scale for light weight fabrics. The five dry warp readings were averaged for the dry warp

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10 American Society for Testing Materials Committee D-13 on Textile Materials, op. cit. p. 173.

tearing strength.

The same procedure was used to determine the average wet warp tearing strength and dry and wet filling tearing strength.

The percentage change in breaking strength was determined using the following formula: $\frac{A-B}{A} \times 100 = C$. In the formula A is the original breaking strength, B is the breaking strength after laundering or dry cleaning and C is the percentage change in breaking strength.

Crease Resistance. The Monsanto Recovery Tester was used to determine crease resistance in each fabric in the original state and following the first and fifth laundering and dry cleaning. The standards established by the American Association of Textile Chemists and Colorists were used.[11]

All tests were determined on flat and wrinkle free fabrics conditioned at 65 $\pm$ 2% r.h., 70 $\pm$ 2° F. for at least eight hours.

Five warp test specimens were cut and placed in the wrinkle recovery tester according to the detailed instructions given in the standard procedure.

The recordings were taken with the degree scale in the A position or 0° - 180° line horizontal. The dangling edge of the fabric specimen was kept in line with the vertical line on the dial face. The dial face was read at the end of a five minute recovery period.

The percentage of crease resistance was calculated by dividing the degrees of recovery by one-hundred-eighty and multiplying by one

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11 American Association of Textile Chemists and Colorists, *op. cit.*, pp. 171-172.

hundred. The five warp measurements of percentage of crease resistance were averaged and stated as the percentage crease resistance.

The same procedure was used for determining the crease resistance in the filling direction.

The percentage change in crease resistance in both warp and filling directions after the first and fifth laundering and dry cleaning was calculated using the following formula: $\frac{A-B}{A} \times 100 = C$. In the formula A is the original degrees of crease resistance. B is the degrees of crease resistance after laundering or dry cleaning and C is the percentage change in crease resistance.

Light Reflectance. This test was made using the multipurpose Hunter reflectometer.

> This is a machine which was developed primarily to measure apparent reflectance. Because of its high precision, the instrument is well suited for measuring small differences in apparent reflectance of nearly identical samples.[12]
>
> A specimen is placed in the instrument and readings through three filters, in three different places on the fabric are taken consecutively. By taking measurements in this manner, positioning errors and separate-filter-standardization errors are eliminated. The relative reflectances through the different tristimulus filters indicate color and the instrument will determine these differences with high precision.[13]

An average of the percentage reflectance of three filters was

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12 Richard S. Hunter, A Multipurpose Photoelectric Reflectometer, (Washington: U. S. Department of Commerce, Vol. 25, November 1940), p. 581.

13 The Gardner Multipurpose Reflectometer, A Booklet of Instructions published by Gardner Laboratory, Bethesda, Maryland, p. 2.

taken for each original test sample and for the samples following the first and fifth laundering and the first and fifth dry cleaning.

The percentage change in light reflectance after the first and fifth laundering and dry cleaning was determined using the following formula: $\frac{A-B}{A} \times 100 = C$. In the formula A is the percentage light reflectance of the original. B is the percentage light reflectance after laundering or dry cleaning and C is the percentage change in light reflectance.

CHAPTER IV

PRESENTATION OF DATA

I. SELECTION OF FABRICS

The curtain fabrics for the study were purchased from retail stores in the vicinity of Greensboro. The selected fabrics presented a variety of textures and fiber content. The ten glass curtain fabrics selected for the study were all of recently developed synthetic fibers with the exception of one fabric constructed of a combination of cotton filling yarns and synthetic warp yarns.

The fabrics used are shown in Illustration I. They are grouped into three classifications according to fabric name or fabric appearance as (1) marquisettes, (2) ninons, and (3) novelty fabrics.

Prices of the fabrics ranged from twenty-five cents to one dollar and ninety-eight cents per yard.

II. ANALYSIS OF FABRIC CONSTRUCTION

All fabrics used were woven of yarns containing one fiber with the exception of Fabric 7 which was constructed with blended filling yarns of acetate and Fortisan. Fabrics 8 and 9 contained combinations of yarns. Combination as it is used in this study means the construction of the fabric with warp yarns of one fiber and filling yarns of another fiber.

The data pertaining to the yarn and fabric construction of the fabrics used in the study are compiled in Table I.

Fiber Content. Laboratory analysis of the fiber content of the ten

ILLUSTRATION I

FABRICS USED IN THE STUDY

GROUP I

SHEER MARQUISETTE FABRICS

FABRIC 1

FABRIC 2

FABRIC 3

ILLUSTRATION I (Continued)

FABRICS USED IN THE STUDY

GROUP II

NINON FABRICS

FABRIC 4

FABRIC 5

FABRIC 6

ILLUSTRATION I (Continued)

FABRICS USED IN THE STUDY

GROUP III

NOVELTY FABRICS

FABRIC 7

FABRIC 8

FABRIC 9

FABRIC 10

TABLE I

DATA PERTAINING TO FABRIC CONSTRUCTION

Fabric Number	Warp Per Cent	Warp Fiber	Filling Per Cent	Filling Fiber	Weave	Fabric Thickness (Inches)	Thread Count Warp	Thread Count Filling	Weight (Oz./sq.yd.)
1	100	Viscose	100	Viscose	Leno	.011	28	46	1.5
2	100	Nylon	100	Nylon	Leno	.009	58	35	1.0
3	100	Dacron	100	Dacron	Leno	.006	51	35	0.8
4	100	Acetate	100	Acetate	Plain	.006	69	80	1.6
5	100	Arnel	100	Arnel	Plain	.008	83	96	1.8
6	100	Dacron	100	Dacron	Plain	.005	74	83	1.4
7	100	Acetate	62.6*	Acetate	Plain	.007	103	71	1.8
8	100	Dacron	100	Viscose	Leno	.033	30	19	5.4
9	100	Dacron	100	Cotton	Leno	.015	52	28	2.5
10	100	Fiberglas	100	Fiberglas	Leno	.016	28	17	4.1

Fabric Number	Twist Count Warp	Twist Count Filling	Denier (TYPP) Warp	Denier (TYPP) Filling	Yarn Number Warp	Yarn Number Filling	Filament Count Warp	Filament Count Filling	Staple Length (Inches) Warp	Staple Length (Inches) Filling
1	18	19	205.35	200.54	—	—	37	39	—	—
2	20	21	60.51	60.51	—	—	14	14	—	—
3	17	18	62.59	60.64	—	—	61	31	—	—
4	25	24	67.08	62.53	—	—	18	20	—	—
5	25	30	61.50	59.64	—	—	16	21	—	—
6	16	20	58.35	54.61	—	—	31	32	—	—
7	18	2	151.05	29.02	—	—	30	88	—	—
8	23	8**	—	2.05	182.15	—	—	187	1.20	—
9	17	23	63.12	—	—	7.99	34	—	—	1.80
10	5	11**	10.76	3.65	—	—	14	141	—	—

*37.4 Fortisan

**Overall Twist

fabrics selected for the study identified the eight different fibers that were used and determined the percentage of each fiber present.

The percentage content of each fabric is given in Table I.

The fibers used were classified as (1) natural fibers, (2) regenerated cellulosic synthetics, (3) glass fibers, and (4) thermoplastic synthetics.[1] The natural fiber, cotton, was used in Fabric 9. The regenerated cellulosic fibers used were (1) viscose, in the warp and filling yarns of Fabric 1, and in the filling yarns of Fabric 8; (2) acetate, in the warp and filling yarns of Fabrics 4 and 7; (3) Fortisan, in the filling yarns of Fabric 7; and (4) Arnel, in the warp and filling yarns of Fabric 5.

The glass fiber, Fiberglas, was used in the warp and filling yarns of Fabric 10.

The thermoplastic synthetics used were (1) nylon, in the warp and filling yarns of Fabric 2; and (2) Dacron, in the warp and filling yarns of Fabrics 3 and 6, and in the warp yarns of Fabrics 8 and 9.

Fabric 7 was the only fabric in which a blend of fibers was used. This fabric was constructed with filling yarns of 37.4 per cent Fortisan and 62.6 per cent acetate and warp yarns of 100 per cent acetate.

Weave. All fabrics selected were constructed with a plain or leno weave. Fabrics 1, 2, 3, 8, 9, and 10 were constructed with a leno weave. Fabrics 4, 5, 6, and 7 were constructed with a plain weave. A ply novelty yarn construction was used for novelty effect in the filling direction of Fabrics 8 and 10.

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1 Norma Hollen and Jane Saddler, Textiles, (New York: Macmillan Company, 1955), p. 6.

Thread Count. The thread count of the fabrics constructed with a leno weave ranged from 28 to 58 warp threads per inch, and from 17 to 46 filling threads per inch. The fabrics constructed with a plain weave ranged from 69 to 103 warp threads per inch and from 71 to 96 filling threads per inch.

Weight. There was a variation of weight per square yard ranging from 0.8 to 5.4 ounces per square yard, with six of the fabrics falling within a range of 1.0 to 1.8 ounces per square yard. Fabric 3, a sheer Dacron marquisette, weighed only 0.8 ounces per square yard and Fabrics 8, 9, 10, the novelty leno weave fabrics weighed from 2.5 to 5.4 ounces per square yard.

Fabric Thickness. Much variation was found in the thickness of the fabrics used in the study. The thickness ranged (1) from .006 to .011 of an inch in the sheer marquisettes, (2) from .005 of an inch to .008 of an inch in the ninons and (3) from .007 to .033 of an inch in the novelty fabrics. Seven of the fabrics fell within the range of .005 to .011 of an inch in fabric thickness.

Twist. The amount of twist in the yarns of these selected fabrics ranged from 5 to 25 turns per inch in the warp yarns and from 2 to 30 turns per inch in the filling yarns. The sheer marquisettes had from 17 to 20 turns per inch in the warp yarns and from 18 to 21 turns per inch in the filling yarns. The ninons had from 16 to 25 turns per inch in the warp yarns and from 20 to 30 turns per inch in the filling yarns. The novelty fabrics had from 5 to 23 turns per inch in the warp yarns and from 2 to 23 turns per inch in the filling yarns. Fabrics 8 and 10 were constructed with novelty filling yarns but only the overall twist is given in Table I.

Denier. The denier of yarns used in the construction of the fabrics showed much variation. The range of variation was from 10.8 to 205.4 in the warp yarns and from 2.1 to 200.5 in the filling yarns. The sheer marquisettes ranged from 60.5 to 205.4 in denier of the warp yarns and from 60.5 to 200.5 in denier of the filling yarns. The ninon fabrics ranged from 58.4 to 67.1 denier of the warp yarns and from 54.6 to 62.5 denier of the filling yarns. The novelty fabrics ranged from 10.8 to 151.1 in the warp yarn denier and from 2.1 to 29.0 denier in the filling yarns.

Filament Count. The filament count of the fabrics constructed of filament yarns ranged from 14 to 61 in the warp yarns and from 14 to 187 in the filling yarns. The sheer marquisettes ranged from 14 to 61 in the warp direction and from 14 to 39 in the filling direction.

The ninon fabrics ranged in filament count from 16 to 31 in the warp yarns and from 20 to 32 in the filling yarns.

The novelty fabrics had a filament count ranging from 14 to 34 in the warp yarns and from 38 to 187 in the filling yarns.

Yarn Number. The warp yarns of Fabric 8 were constructed from Dacron staple and had an average yarn number of 182.15. The filling yarns of Fabric 9 were constructed from cotton staple and had a yarn number of 7.99.

Staple length. The staple length of the warp yarn in Fabric 8 was 1.20 and that of the filling yarn of Fabric 9 was 1.80.

III. DATA FROM LABORATORY ANALYSIS OF FABRIC SERVICEABILITY

Dimensional Changes Following Laundering and Dry Cleaning

Dimensional changes in curtain fabrics are of great importance in the selection and care of the fabrics. Wingate states that "The American Home Economics Association advises consumers to insist on ... goods that are guaranteed not to shrink more than two percent."[2] Skinkle says that "In general, we may say that even without any label or claim, a shrinkage of more than five percent in either direction is excessive."[3]

For this study, a dimensional change of up to two percent was considered acceptable. Any dimensional change above two percent but not exceeding five percent was considered objectionable. Any dimensional change exceeding five percent was considered excessive.

Fabric 10, Fiberglas marquisette, was the only fabric having no more than the acceptable two percent dimensional change in both warp and filling direction when laundered and dry cleaned five times. Fabric 8, a novelty Dacron marquisette, showed less than two percent dimensional change in both warp and filling direction after dry cleaning five times. Fabric 2, a nylon marquisette, showed less than two percent dimensional change in both warp and filling direction after laundering five times. Stretch occurred only in the warp direction of Fabric 2 and was only 0.30 percent in the warp direction following the first dry cleaning.

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[2] Isabel Wingate, Textile Fabrics, (New York: Prentice Hall, Inc., 1949), p. 317.

[3] John Skinkle, Textile Testing, (New York: Chemical Publishing Company, Inc., 1949), p. 118.

Data showing the percentage of dimensional change after laundering and dry cleaning are given in Table II and presented graphically in Illustration II.

Sheer Marquisette Fabrics. Of the three sheer marquisettes, only one of the fabrics had objectionable dimensional change after the first laundering. Fabric 1, a rayon marquisette, shrank 10.64 percent in the warp direction. This change would approximate a three and one-half inch shrinkage per square yard. Shrinkage of less than two percent occurred only in the filling direction of Fabrics 2 and 3.

Laundering five times was satisfactory only for Fabric 2 of the sheer marquisette group. Fabric 3, although stable following the first laundering did not remain so following five launderings. Fabric 1, although stable in the filling direction had excessive shrinkage in the warp direction.

Dry cleaning five times produced more shrinkage in the filling direction but less in the warp direction of Fabric 1 than did laundering. Objectionable and excessive shrinkage of from 3.60 percent occurred in both the warp and filling directions following the first and fifth dry cleaning. Less shrinkage occurred in both the warp and filling directions of Fabrics 2 and 3 after dry cleaning than after laundering.

From the tests made, Fabrics 2 and 3 retained acceptable dimensional stability only after the first dry cleaning. Fabric 1 did not dry clean satisfactorily.

Ninon Fabrics. All of the ninon fabrics were unstable dimensionally following both the first and fifth laundering and after the first and fifth dry cleaning. Shrinkage in each direction of all three fabrics

TABLE II

PERCENTAGE DIMENSIONAL CHANGE AFTER LAUNDERING AND DRY CLEANING

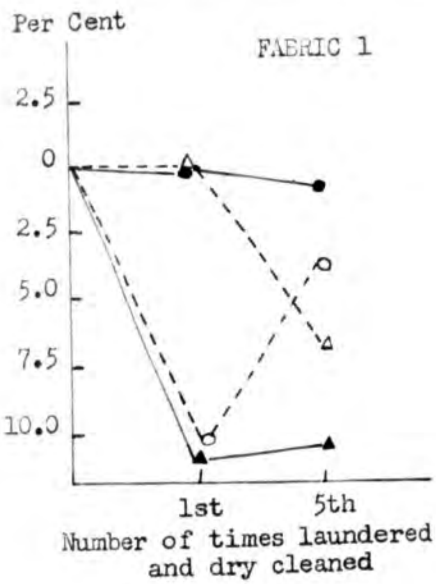
Fabric No.	Number of Times Cleaned			
	One		Five	
	Warp	Filling	Warp	Filling
	Laundered			
1	-10.64	-0.32	-10.00	-0.96
2	- 1.44	-1.16	- 1.80	-1.10
3	- 1.36	-0.64	- 4.04	-4.52
4	- 4.28	-1.52	- 5.00	-4.20
5	- 3.32	-2.00	- 3.40	-1.20
6	- 1.92	-2.08	- 5.36	-4.36
7	- 5.76	-2.00	- 4.96	-1.52
8	-12.40	-6.08	-11.70	-7.70
9	- 3.84	-3.28	- 6.60	-3.70
10	- 0.00	-0.00	- 1.30	-0.00
	Dry Cleaned			
1	- 0.00	-10.00	- 6.56	-3.60
2	+ 0.30	- 0.20	- 1.10	-10.90
3	- 1.00	- 0.20	- 2.24	-3.60
4	- 2.90	- 2.20	- 4.60	-2.90
5	- 0.80	- 1.20	- 3.50	-1.00
6	- 4.90	- 3.80	- 4.80	-4.16
7	- 0.20	- 0.80	- 0.08	-2.64
8	- 1.00	- 0.00	- 1.80	-1.00
9	- 1.10	- 1.10	- 1.60	- 2.50
10	- 0.00	- 0.00	- 0.00	-0.00

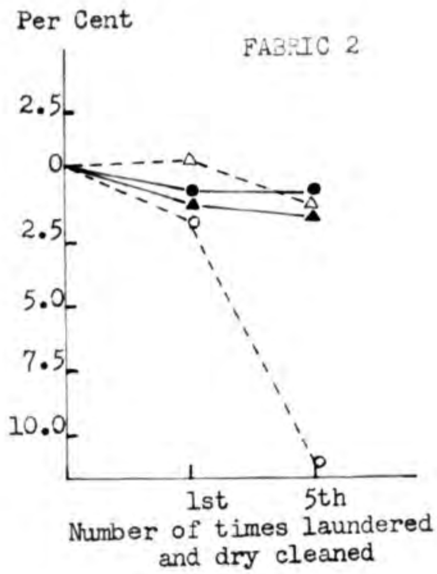
ILLUSTRATION II

PERCENTAGE DIMENSIONAL CHANGE AFTER LAUNDERING AND DRY CLEANING

SHEER MARQUISETTE FABRICS

Warp after laundering ▲ ————
Filling after laundering ● ————
Warp after dry cleaning △ - - - - - -
Filling after dry cleaning ○ - - - - - -





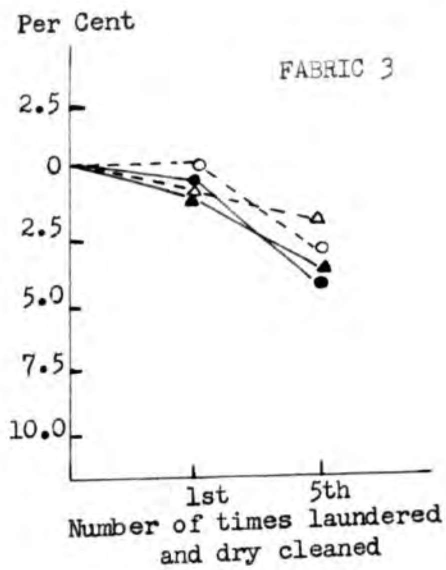
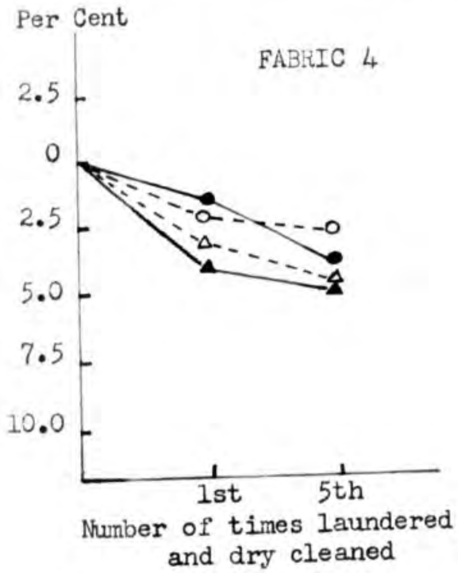


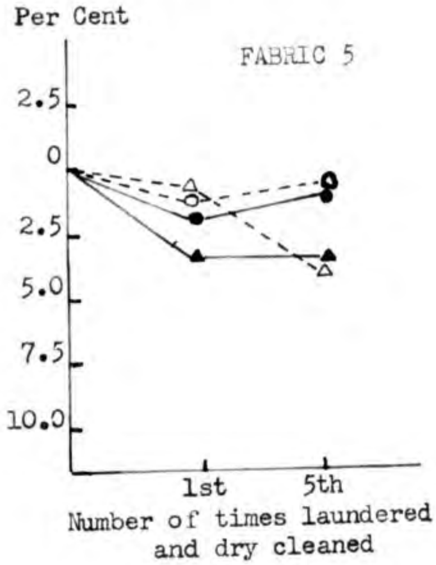
ILLUSTRATION II (Continued)

PERCENTAGE DIMENSIONAL CHANGE AFTER LAUNDERING AND DRY CLEANING

NINON FABRICS

Warp after laundering ▲ ————
Filling after laundering ● ————
Warp after dry cleaning △ - - - - - -
Filling after dry cleaning ○ - - - - - -





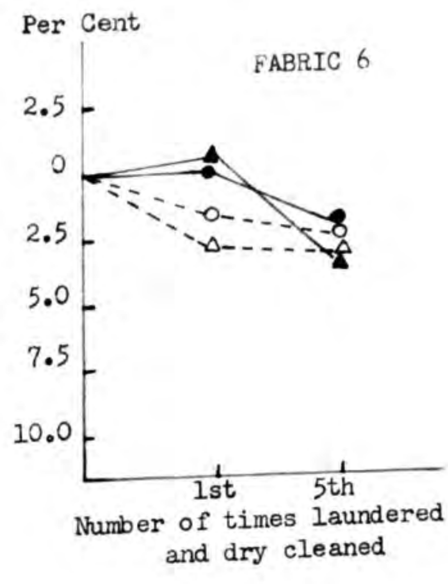
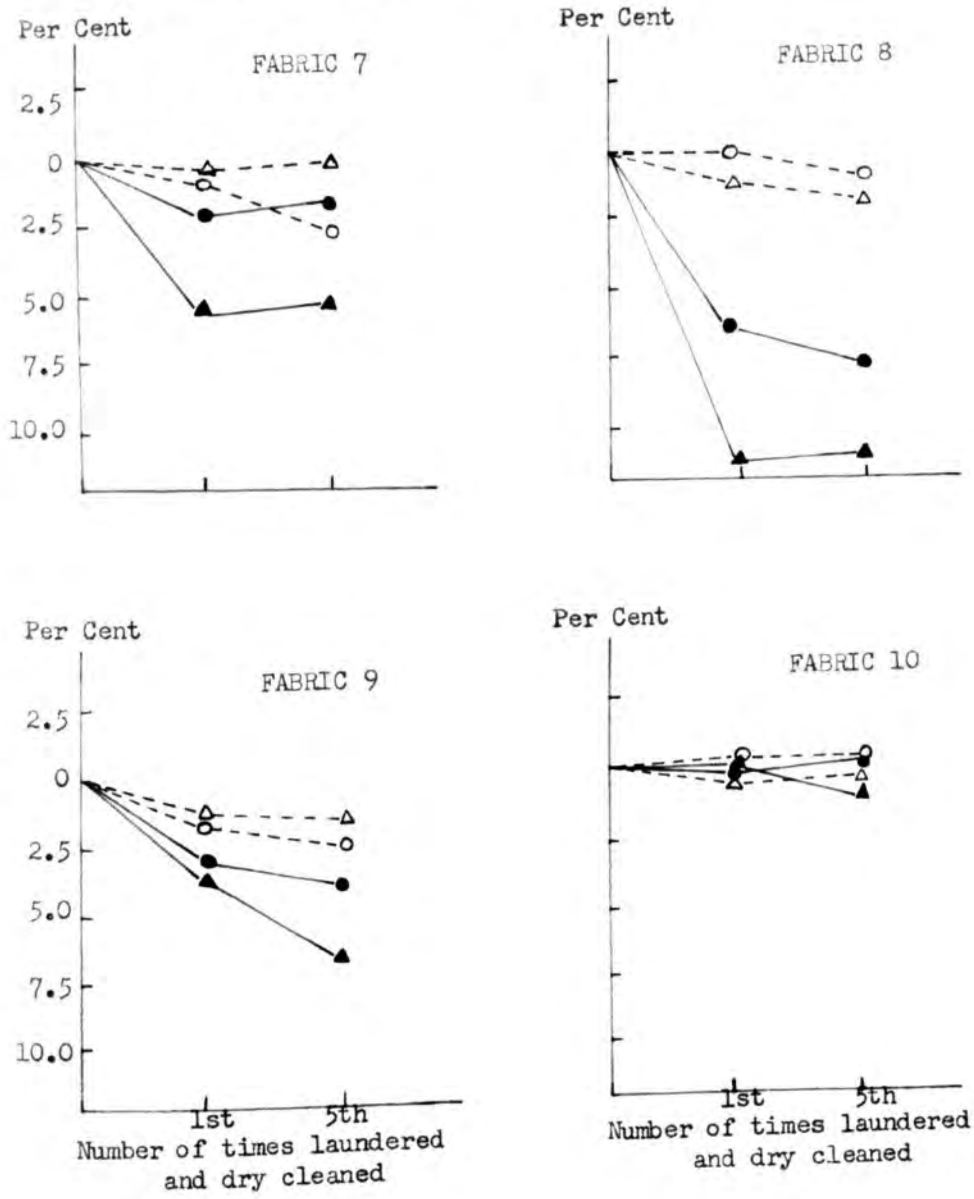


ILLUSTRATION II (Continued)

PERCENTAGE DIMENSIONAL CHANGE AFTER LAUNDERING AND DRY CLEANING

NOVELTY FABRICS

Warp after laundering ▲ ————
Filling after laundering ● ————
Warp after dry cleaning △ - - - - - -
Filling after dry cleaning ○ - - - - - -



ranged from 1.92 to 4.28 percent following the first laundering and from 1.20 to 5.36 percent following the fifth laundering. Shrinkage of the fabrics ranged from .80 to 4.90 percent following the first dry cleaning and from 1.00 to 4.80 percent following the fifth dry cleaning. The filling of Fabric 5 was the only direction of any of the fabrics having acceptable dimensional change following either the fifth laundering or dry cleaning process.

Less shrinkage occurred in all the fabrics following the fifth dry cleaning than after the fifth laundering. Fabric 6 withstood laundering once without objectionable change. Fabrics 2 and 3 could be dry cleaned once without objectionable change. None of the fabrics laundered or dry cleaned successfully five times. Although acceptable shrinkage occurred in the filling direction, objectionable or excessive changes occurred in the warp direction. Dimensional changes in this direction are those which would make the fabrics most unsatisfactory for use by the consumer.

Novelty Fabrics. Of the four novelty fabrics, Fabric 10, Fiberglas marquisette, had good dimensional stability following the fifth laundering and dry cleaning. The only dimensional change in the Fiberglas fabric was a 1.30 percent shrinkage in the warp direction following the fifth laundering.

Fabric 7 was the only fabric of the three remaining fabrics having acceptable stability following laundering. Objectionable and excessive instability occurred in the warp direction of the three novelty fabrics following the first and fifth launderings. Dimensional change in both warp and filling directions increased only in Fabric 9 after the fifth laundering.

Excessive dimensional instability occurred only in the filling directions of Fabrics 7 and 9 following the fifth dry cleaning. Fabric 8 remained stable throughout the five cleanings. Dimensional changes increased after the fifth dry cleaning of Fabrics 8 and 9.

Laundering was a satisfactory method of cleaning Fabric 10, the Fiberglas fabric. Dry cleaning was the most satisfactory method of cleaning Fabrics 7, 8, and 9, although a slightly objectionable shrinkage occurred in the filling direction of Fabrics 7 and 9 following the fifth dry cleaning.

Breaking Strength Changes Following Laundering and Dry Cleaning

The breaking strength in pounds before and after laundering and dry cleaning is given in Table III. The percentage changes in breaking strength after laundering and dry cleaning are also given in Table III. The graphic presentation of percentage changes in breaking strength is shown in Illustration III.

Sheer Marquisette Fabrics. Of the three sheer marquisette fabrics, Fabric 2, nylon, retained the greatest percentage of its breaking strength after laundering and dry cleaning five times. Fabric 1, rayon, had the greatest change in strength. The fabric lost 88.7 percent in wet strength and 45.5 percent in dry strength after the fifth cleaning processes. Fabric 3, Dacron, had very erratic changes in strength but less loss of strength than Fabric 1. Loss of strength of the sheer fabrics after the fifth laundering ranged from 1.6 to 86.0 percent. Loss of strength after the fifth dry cleaning ranged from 0.5 to 88.7 percent. Gain of strength ranged from 0.0 to 9.9 percent after the fifth laundering. Gain of strength after the fifth dry cleaning ranged from 4.9 to

Fabric Number	One: Dry Warp	One: Dry Filling	One: Wet Warp	One: Wet Filling	Five: Dry Warp	Five: Dry Filling	Five: Wet Warp	Five: Wet Filling
1	20.	9.4	6.8	4.1	17.2	10.4	7.6	3.6
2	29.	17.2	28.3	17.6	33.8	19.0	27.8	18.0
3	25.	16.8	25.7	16.6	29.0	19.4	29.0	19.8
4	11.	9.7	5.6	3.1	11.2	8.2	5.6	3.8
5	10.	9.8	6.6	5.7	9.8	9.0	6.6	5.9
6	40.	35.2	44.7	44.3	45.4	47.2	50.6	44.2
7	22.	28.0	19.7	15.2	31.4	24.0	25.0	11.2
8	11.	40.4	16.9	18.8	14.2	37.2	16.6	16.0
9	28.	52.4	36.0	26.9	30.6	43.6	32.2	22.6
10	28.	28.3	23.8	22.1	30.4	19.2	25.8	14.8
	E N G T H							
1		-21.7	-80.6	-82.2	-15.7	-13.3	-78.3	-88.7
2		+2.4	+8.8	-6.5	+11.5	+13.1	+6.9	+7.8
3		-9.2	+5.8	-16.6	+12.4	+4.9	+19.3	-0.5
4		-3.9	+1.8	-45.6	+1.8	-18.8	+1.8	-33.3
5		-16.9	-9.6	-9.5	-3.9	-23.7	-9.6	-6.3
6		-12.2	+9.6	+7.0	+5.5	+17.7	+24.0	+6.8
7		+17.6	-24.2	+29.9	+23.9	+0.8	-3.8	-4.3
8		+4.1	-11.5	+6.2	+11.2	-4.1	-13.1	-9.6
9		+36.5	+2.3	+14.5	+6.5	-13.5	-8.5	-3.8
10		+24.1	-15.0	-9.4	+5.3	-15.8	-7.9	-39.3

TABLE III

CHANGES IN BREAKING STRENGTH AFTER LAUNDERING AND DRY CLEANING

(Pounds Per Inch)

Fabric Number	Original				Number of Times Laundered								Number of Times Dry Cleaned							
					One				Five				One				Five			
	Dry		Wet		Dry		Wet		Dry		Wet		Dry		Wet		Dry		Wet	
	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling
1	20.4	12.0	35.0	23.0	19.0	13.1	6.3	3.8	10.7	5.1	4.9	4.2	19.5	9.4	6.8	4.1	17.2	10.4	7.6	3.6
2	29.9	16.8	26.0	16.7	28.1	15.2	28.6	17.8	28.6	16.8	25.0	14.4	27.0	17.2	28.3	17.6	33.8	19.0	27.8	18.0
3	25.4	18.5	24.3	19.9	19.4	14.5	24.3	17.4	28.2	18.2	23.2	14.7	24.7	16.8	25.7	16.6	29.0	19.4	29.0	19.8
4	11.0	10.1	5.5	5.7	9.3	10.9	4.4	5.6	7.9	5.4	3.5	2.9	10.9	9.7	5.6	3.1	11.2	8.2	5.6	3.8
5	10.2	11.8	7.3	6.3	11.6	10.4	7.0	6.6	10.2	9.4	6.7	6.1	10.6	9.8	6.6	5.7	9.8	9.0	6.6	5.9
6	40.3	40.1	40.8	41.4	31.8	31.4	43.4	32.4	47.0	44.4	34.2	37.4	37.8	35.2	44.7	44.3	45.4	47.2	50.6	44.2
7	22.9	23.8	26.0	11.7	16.7	18.9	20.4	11.0	15.0	17.4	14.4	10.2	23.7	28.0	19.7	15.2	31.4	24.0	25.0	11.2
8	11.8	38.8	19.1	17.7	11.1	41.2	18.8	17.3	11.6	15.9	15.9	15.8	12.0	40.4	16.9	18.8	14.2	37.2	16.6	16.0
9	28.6	38.4	35.2	23.5	28.4	43.3	34.2	23.6	26.6	36.5	30.8	17.9	33.1	52.4	36.0	26.9	30.6	43.6	32.2	22.6
10	28.8	22.8	28.0	24.4	28.5	25.3	27.4	24.9	29.8	23.4	21.8	17.4	27.6	28.3	23.8	22.1	30.4	19.2	25.8	14.8
	PERCENTAGE CHANGE IN STRENGTH																			
1					-6.9	+6.5	-82.0	-40.0	-47.5	-57.5	-86.0	-81.7	-4.4	-21.7	-80.6	-82.2	-15.7	-13.3	-78.3	-88.7
2					-6.0	-9.5	+10.0	+6.6	-4.3	±0.0	-3.8	-13.8	-9.7	+2.4	+8.8	-6.5	+11.5	+13.1	+6.9	+7.8
3					-23.6	-21.6	± 0.0	-12.6	+9.9	-1.6	-4.5	-26.1	-2.8	-9.2	+5.8	-16.6	+12.4	+4.9	+19.3	-0.5
4					-15.5	+7.9	-20.0	-1.8	-28.2	-46.5	-36.4	-49.1	-0.9	-3.9	+1.8	-45.6	+1.8	-18.8	+1.8	-33.3
5					+13.7	-11.9	-4.1	+4.8	±0.0	-20.3	-8.2	-3.2	+3.8	-16.9	-9.6	-9.5	-3.9	-23.7	-9.6	-6.3
6					-21.1	-21.7	+6.4	-21.7	+14.3	+10.7	-16.2	-9.7	-6.2	-12.2	+9.6	+7.0	+5.5	+17.7	+24.0	+6.8
7					-27.0	-20.6	-21.5	-5.9	-34.4	-26.9	-6.2	-12.8	+3.3	+17.6	-24.2	+29.9	+23.9	+0.8	-3.8	-4.3
8					- 5.9	+6.2	-1.6	-2.3	-1.7	-33.2	-16.8	-10.7	+1.7	+4.1	-11.5	+6.2	+11.2	-4.1	-13.1	-9.6
9					- 0.7	+12.8	-2.8	+0.4	-7.0	-4.9	-12.5	-23.8	+10.5	+36.5	+2.3	+14.5	+6.5	-13.5	-8.5	-3.8
10					- 1.1	+10.9	-2.1	+2.0	+3.4	+2.6	-22.1	-28.7	-4.2	+24.1	-15.0	-9.4	+5.3	-15.8	-7.9	-39.3

ILLUSTRATION III

PERCENTAGE CHANGE IN BREAKING STRENGTH AFTER LAUNDERING AND DRY CLEANING

SHEER MARQUISETTE FABRICS

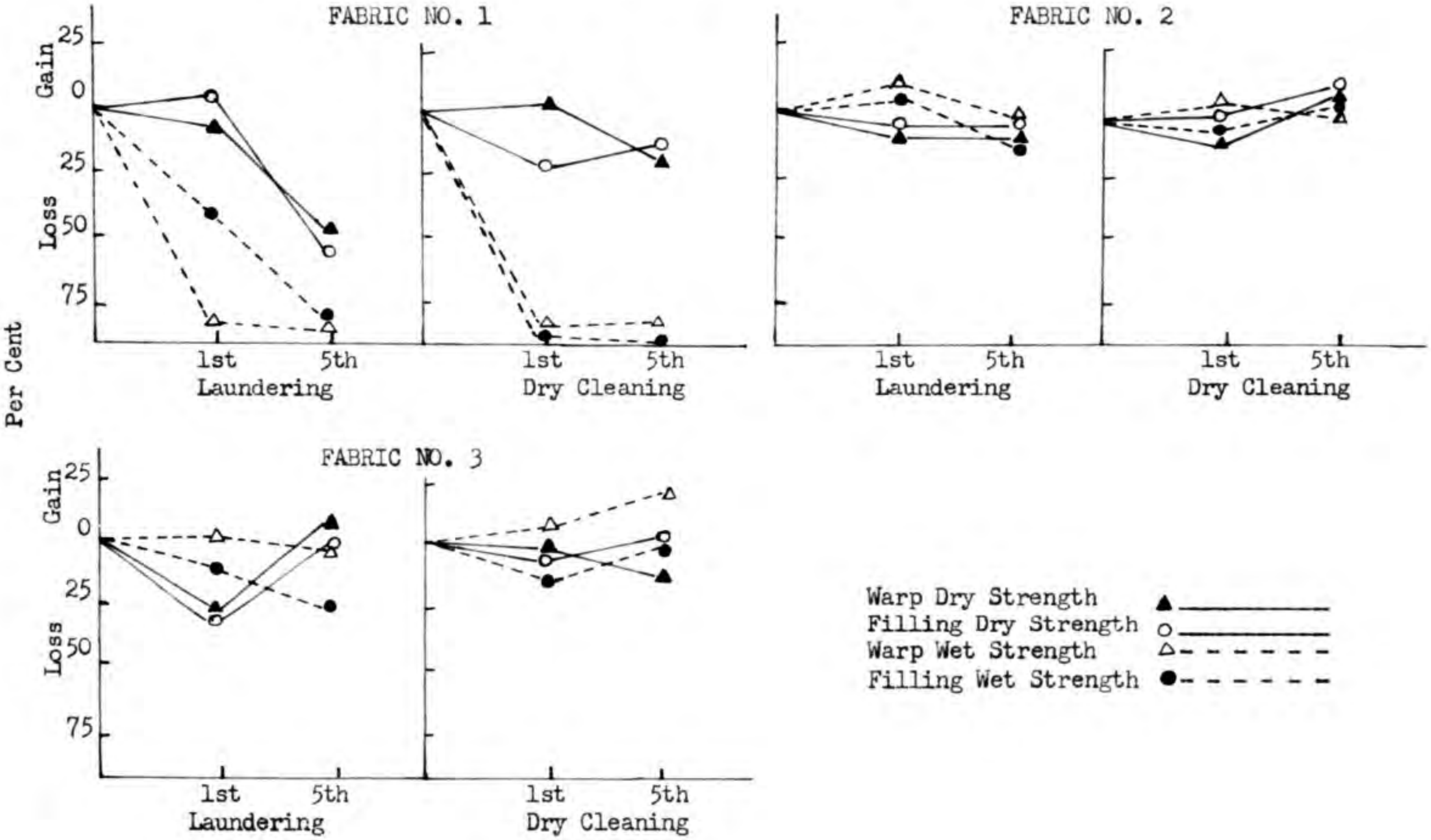


ILLUSTRATION III (Continued)

PERCENTAGE CHANGE IN BREAKING STRENGTH AFTER LAUNDERING AND DRY CLEANING

NINON FABRICS

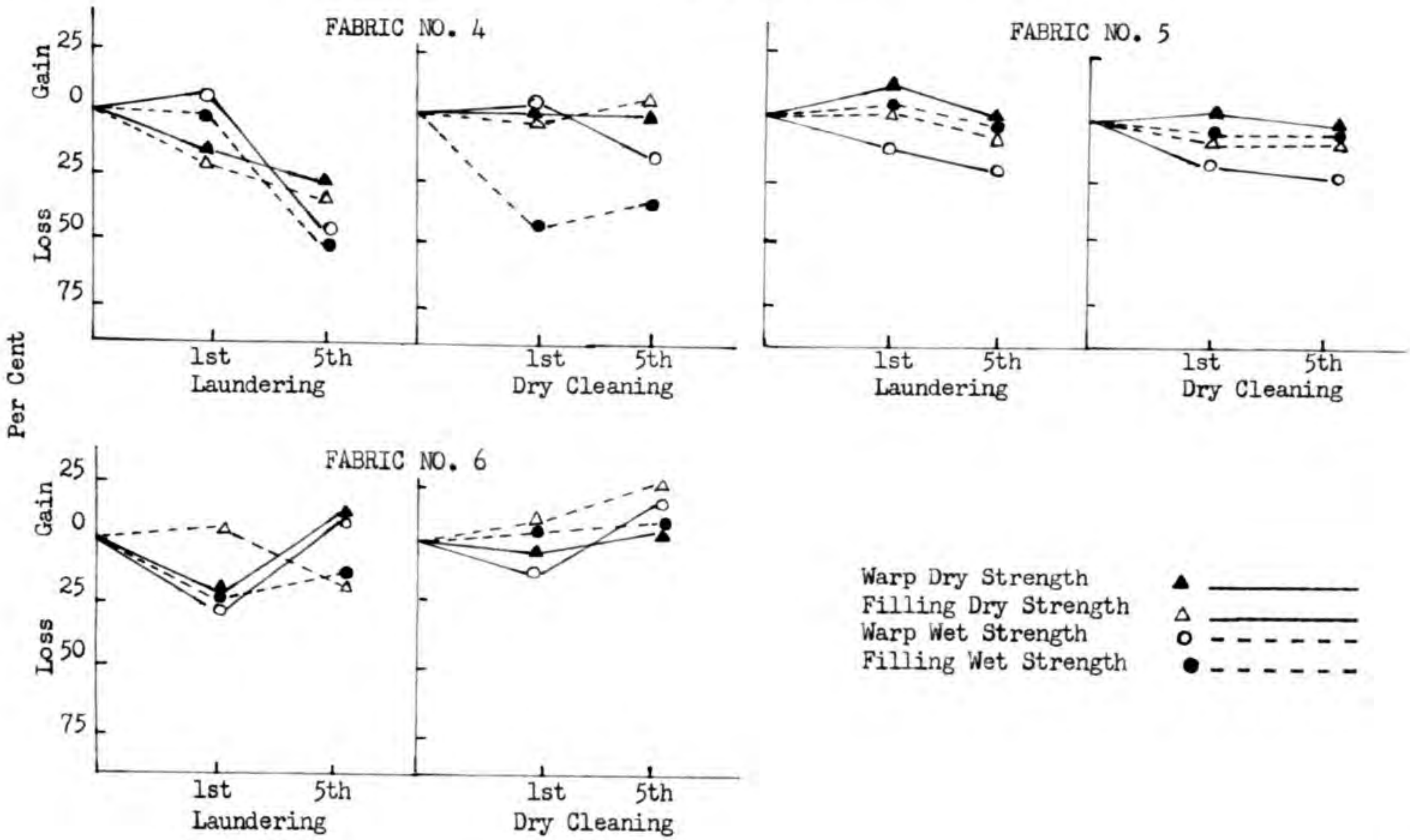
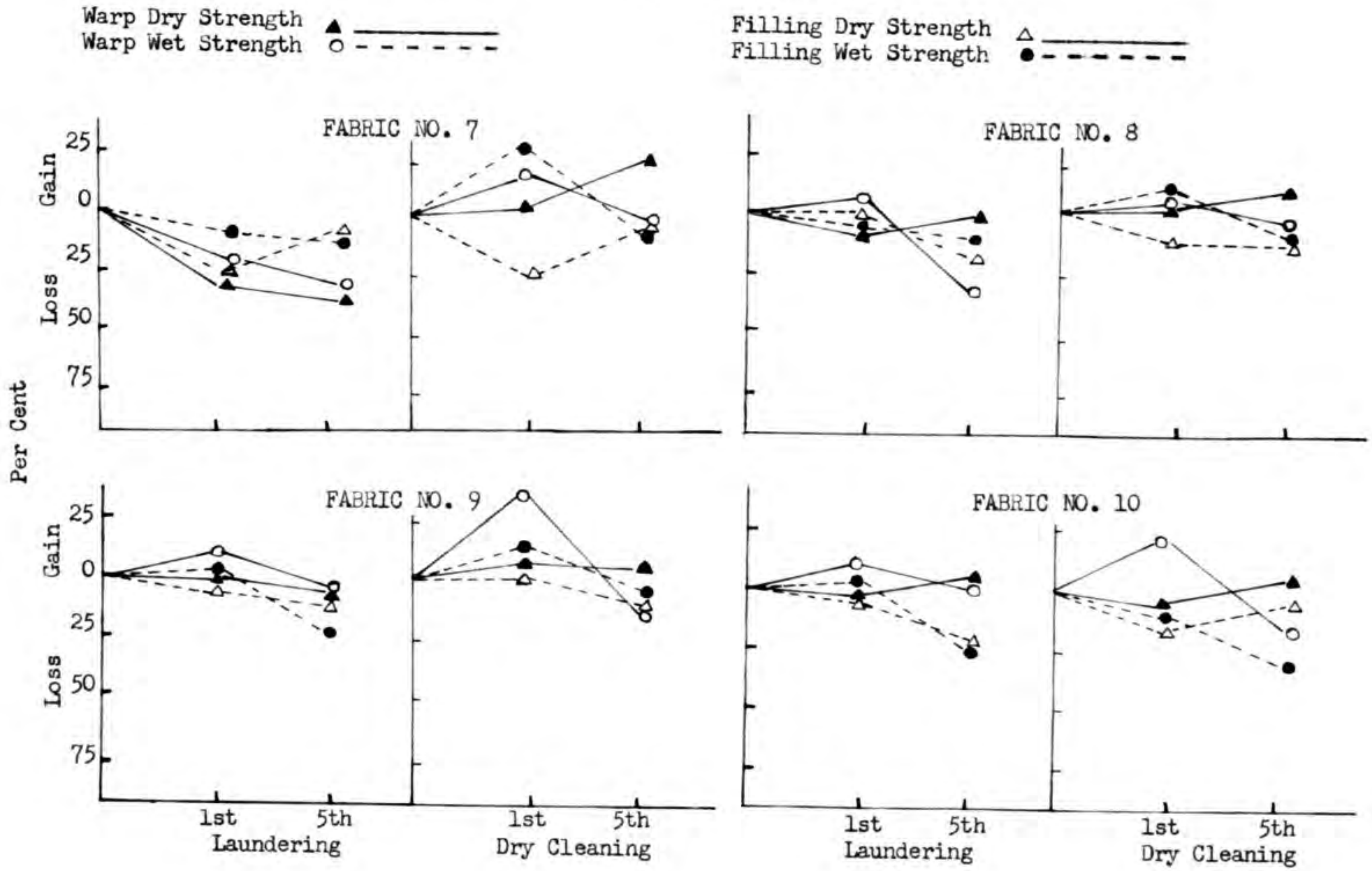


ILLUSTRATION III (Continued)

PERCENTAGE CHANGE IN BREAKING STRENGTH AFTER LAUNDERING AND DRY CLEANING

NOVELTY FABRICS



19.3 percent. The fabric having the greatest increases in strength after both laundering and dry cleaning was Fabric 3, the Dacron marquisette.

After dry cleaning five times Fabric 1 had greater loss of wet strength than after laundering. Fabrics 2 and 3 generally gained more strength following the fifth dry cleaning than after the fifth laundering. The increase in strength could have possibly been due to shrinkage of the thermoplastic fibers during dry cleaning and possibly to the fusing of fibers during pressing.

Ninon Fabrics. All changes in breaking strength of the ninon fabrics were quite variable. Of the three fabrics, Fabric 5, Arnel, had the least fluctuation of strength following five launderings and dry cleanings. Fabric 4, rayon, lost the greatest amount of strength following cleaning. This loss of 49.1 percent in filling wet strength occurred after the fifth laundering. Fabric 6, Dacron, lost as much as thirty-five percent in wet filling strength after the first laundering but gained strength after the fifth laundering and dry cleaning.

Loss in strength after the fifth laundering ranged from 3.2 to 49.1 percent, Loss after the fifth dry cleaning ranged from 3.9 to 33.3 percent. Gain in strength after the fifth laundering ranged from 0.0 to 14.3 percent and after the fifth dry cleaning from 1.8 to 24.0 percent. The greatest percentage of gain in strength occurred in Fabric 6 after the fifth dry cleaning. This gain of 24.0 percent in wet warp strength could have been due to shrinkage of the thermoplastic fiber from heat during the dry cleaning process.

All three fabrics in the ninon group generally lost less strength after dry cleaning five times than after laundering five times. Fabric 5 had very similar changes in strength after both the fifth laundering and dry cleaning.

Fabric 5 showed less erratic changes in wearability, although Fabric 6 would gain more strength after cleaning. The filling yarns of Fabric 4 lost strength after cleaning.

Novelty Fabrics. Changes in the breaking strength of the four novelty fabrics were erratic. Fabric 8 had the least fluctuation of strength after both the laundering and dry cleaning processes. With the exception of Fabric 8, all the fabrics gained more in the filling strength than in the warp strength after the first laundering and dry cleaning. Fabric 8 gained more wet warp strength after the first laundering. Fabrics 7 and 10 continued to gain more in wet and dry filling strength after the fifth dry cleaning. Fabric 10 also gained strength after the fifth laundering.

Loss of strength in the novelty fabrics after the fifth laundering ranged from 1.7 to 34.4 percent and after the fifth dry cleaning from 3.8 to 39.3 percent. The greatest loss occurred in the wet filling strength of Fabric 10 after the fifth dry cleaning. This loss could have been due to breakage of yarns during the tumbling process.

Gain of strength in the novelty fabrics after the fifth laundering ranged from 2.6 to 3.4 percent and after the fifth dry cleaning from 0.8 to 23.9 percent. The greatest gain occurred after the fifth dry cleaning in the dry warp direction of Fabric 7, an acetate and Fortisan blend.

Fabric 8, a Dacron and viscose combination, was stronger after cleaning than the three other fabrics in the novelty group. Fabric 9, a Dacron and cotton combination retained a large percentage of its strength.

TABLE IV

CREASE RESISTANCE BEFORE AND AFTER LAUNDERING AND DRY CLEANING

Fabric Number	Original				Number of Times Laundered							
					One				Five			
	Warp		Filling		Warp		Filling		Warp		Filling	
	Degrees	Per Cent	Degrees	Per Cent	Degrees	Per Cent Change	Degrees	Per Cent Change	Degrees	Per Cent Change	Degrees	Per Cent Change
1	119.6	66.1	145.4	80.8	132.4	+10.7	125.2	-13.8	102.2	-14.5	110.4	-24.0
2	151.2	84.0	140.6	78.1	163.6	+8.2	162.4	+15.5	136.4	- 9.2	149.6	+6.4
3	140.0	77.7	147.4	81.8	132.8	-5.1	138.8	-5.9	140.2	+0.1	146.3	-0.7
4	138.0	76.6	160.6	88.7	154.4	+11.9	145.2	-9.5	108.4	-14.1	110.6	-30.9
5	147.4	81.6	149.4	83.0	147.2	-0.1	141.2	-5.4	137.4	-6.9	135.0	-9.6
6	111.0	61.6	103.2	57.3	142.8	+28.6	154.0	+49.2	153.6	+38.3	158.6	+53.7
7	93.4	51.8	114.6	63.6	106.8	+14.3	128.8	+12.3	118.4	+27.8	117.2	+ 2.3
8	138.2	76.8	137.8	76.6	99.0	-28.2	124.0	-10.0	128.2	-7.2	122.2	-11.3
9	155.8	86.6	135.8	75.4	155.0	-0.5	101.6	-25.2	142.8	-9.1	79.8	-41.2
10	167.0	92.8	151.0	83.8	150.0	-10.2	140.0	-7.3	151.8	-3.1	153.6	+ 1.6
					Number of Times Dry Cleaned							
1					118.0	-1.3	117.8	-18.9	78.0	-34.9	67.0	-53.9
2					150.4	-0.5	143.8	+2.2	158.0	+4.5	138.6	-1.4
3					139.8	-0.1	152.8	+3.6	151.6	+8.3	159.6	+8.2
4					136.6	-1.0	161.6	+0.6	119.8	-13.2	117.6	-26.7
5					145.2	-1.5	132.2	-11.5	110.0	-25.3	121.4	-19.3
6					153.2	+38.0	148.0	+33.6	138.4	+24.6	149.2	+44.5
7					103.4	+1.1	94.4	-17.5	90.4	-3.2	97.7	-13.9
8					123.2	-10.8	135.0	-2.0	93.0	-32.7	111.0	-19.4
9					165.8	+6.4	130.0	-4.4	122.0	-21.0	126.9	-6.5
10					147.0	-12.5	150.8	-0.1	157.2	-5.2	152.6	+1.0

cleaning are given also in Table IV. The percentage change in crease resistance is presented graphically in Illustration IV.

In the original state, three of the ten fabrics did not have the acceptable 125 degrees crease recovery. These fabrics were Fabrics 6 and 7 in both the warp and filling directions and Fabric 1, the rayon marquisette, in the warp direction.

Sheer Marquisette Fabrics. Of the three marquisette fabrics, Fabric 1 was the only fabric that did not retain crease resistance after laundering and dry cleaning five times. After laundering five times the fabrics generally decreased in the percentage of crease resistance. After dry cleaning five times Fabric 1, which originally did not meet the standard 125 degrees crease recovery, decreased from its original crease resistance as much as 34.9 percent in the warp direction and 53.9 percent in the filling direction. The other fabrics generally increased in crease resistance after the fifth dry cleaning.

Fabric 1 required the greatest amount of pressing after both cleaning processes. Fabrics 2 and 3 required less pressing after the dry cleaning than after the laundering process.

Ninon Fabrics. With the exception of Fabric 6, all fabrics of the ninon group had original crease resistance above the acceptable standard 125 degrees.

After the fifth laundering Fabric 4, the rayon ninon was the only fabric having crease resistance below the standard. After the fifth dry cleaning Fabrics 4 and 5 decreased below the standard and Fabric 6 increased above the standard 125 degrees.

Fabric 6, the Dacron ninon required less pressing after laundering

ILLUSTRATION IV

PERCENTAGE CHANGE IN CREASE RESISTANCE AFTER LAUNDERING AND DRY CLEANING

SHEER MARQUISETTE FABRICS

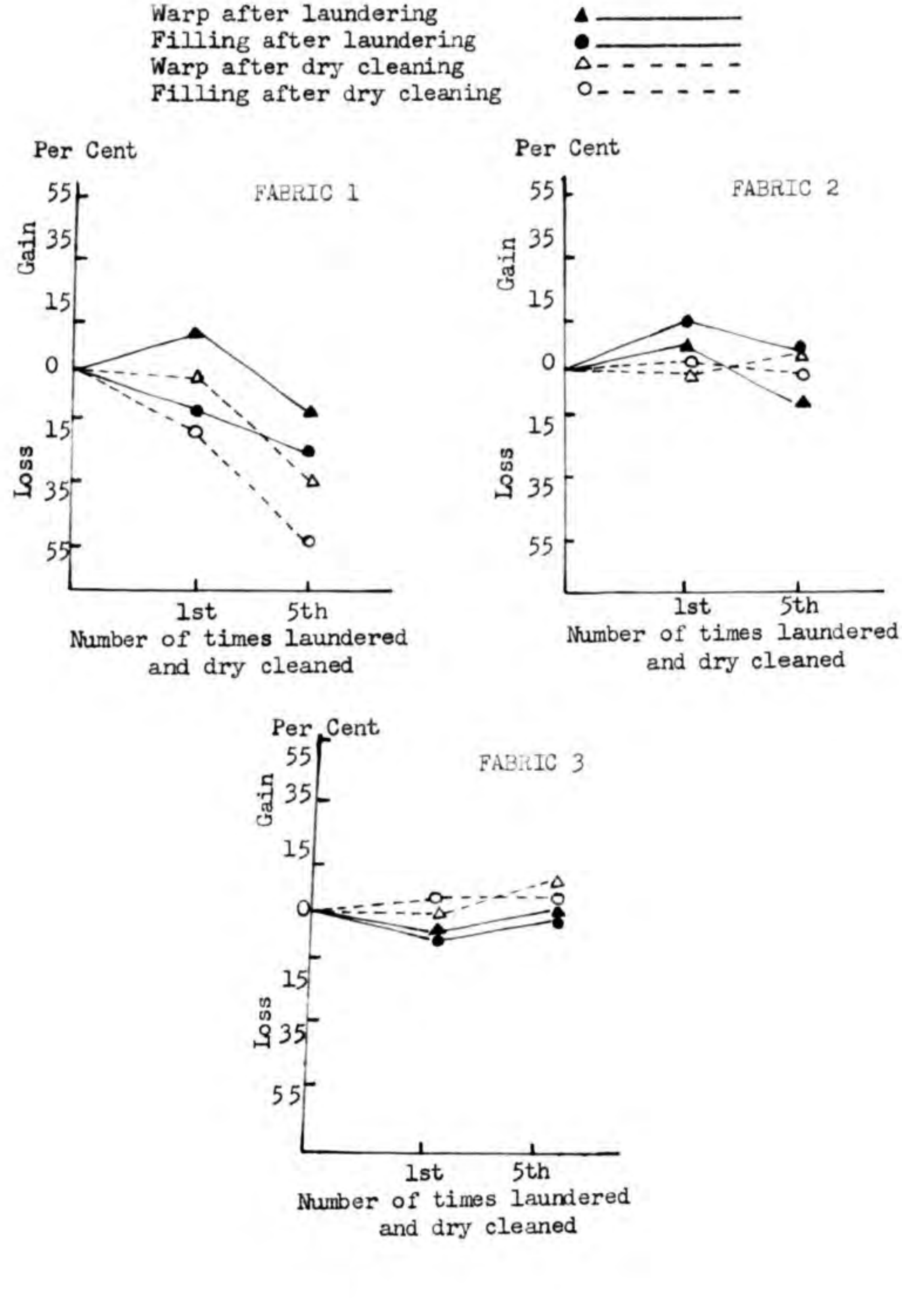
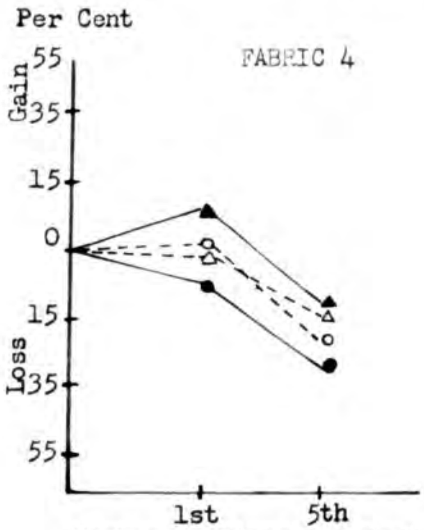


ILLUSTRATION IV (Continued)

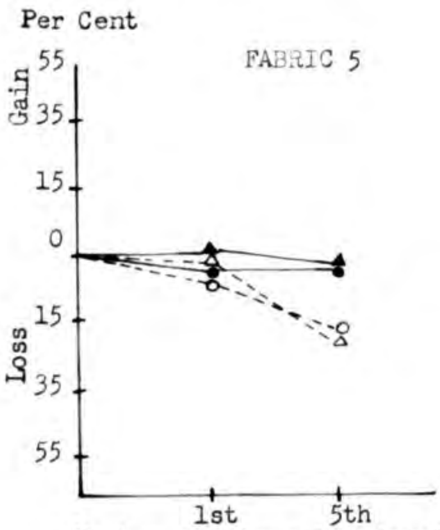
PERCENTAGE CHANGE IN CREASE RESISTANCE AFTER LAUNDERING AND DRY CLEANING

NINON FABRICS

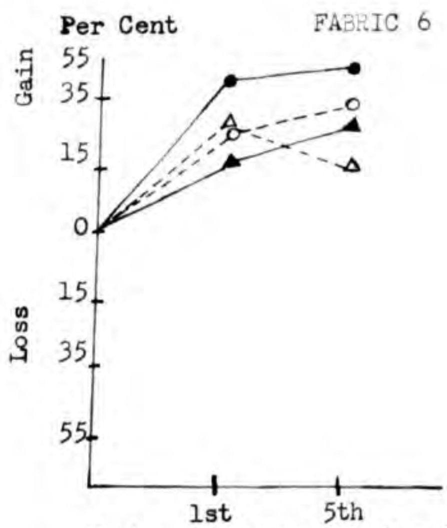
Warp after laundering ▲ ————
Filling after laundering ● ————
Warp after dry cleaning △ - - - - - -
Filling after dry cleaning ○ - - - - - -



Number of times laundered and dry cleaned



Number of times laundered and dry cleaned

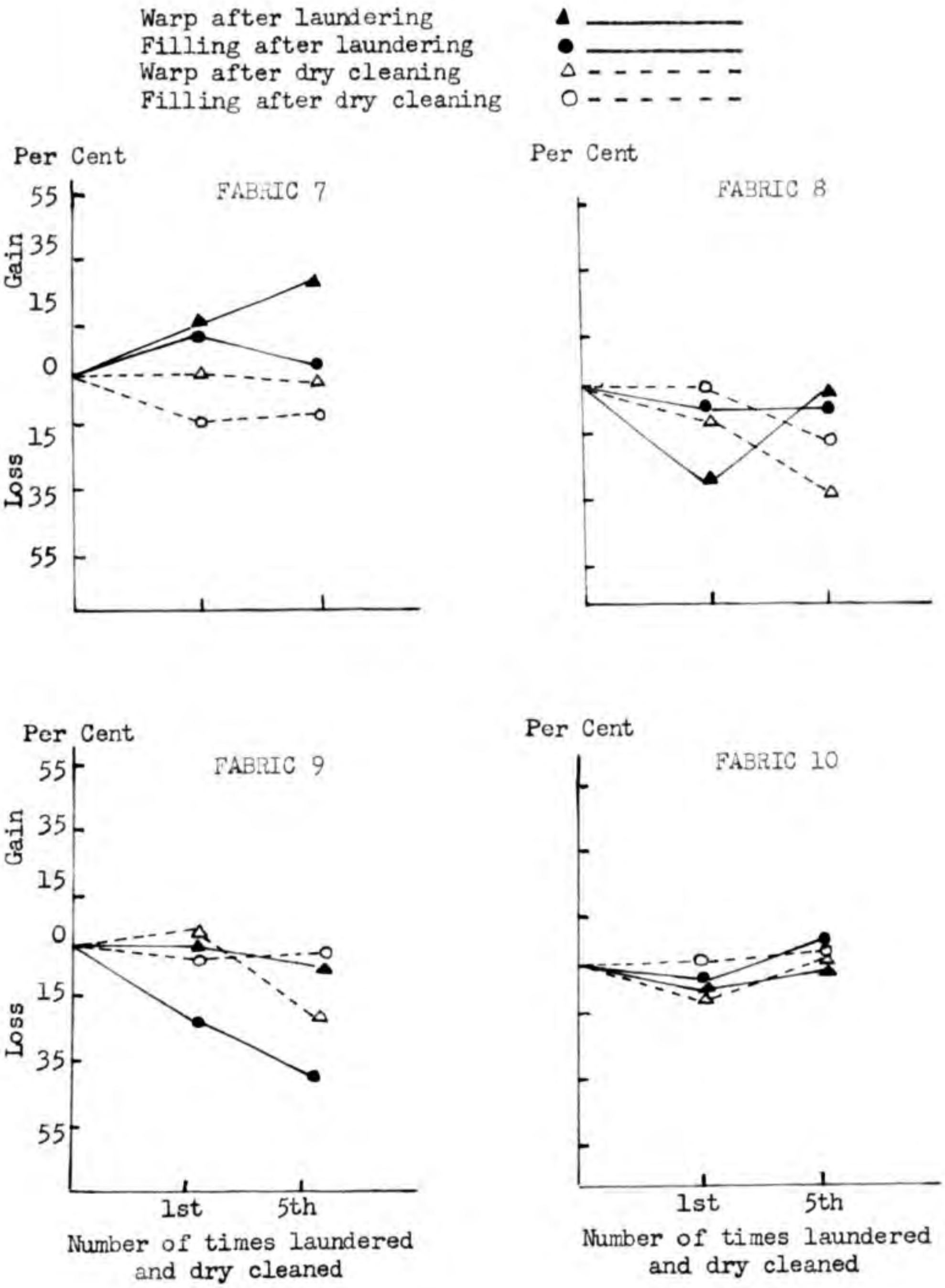


Number of times laundered and dry cleaned

ILLUSTRATION IV (Continued)

PERCENTAGE CHANGE IN CREASE RESISTANCE AFTER LAUNDERING AND DRY CLEANING

NOVELTY FABRICS



and dry cleaning than the other fabrics in the ninon group. Fabric 5 required less pressing after laundering than after dry cleaning. Fabric 4 required the most pressing after both cleaning processes.

Novelty Fabrics. With the exception of Fabric 7, the Fortisan and acetate blend, all fabrics of the novelty group had original crease resistance above the standard 125 degrees.

After the fifth laundering, the crease resistance of Fabric 7 remained low and that of Fabrics 8 and 9 decreased below the standard in the filling direction. After the fifth dry cleaning all four fabrics generally decreased more than after the fifth laundering.

Fabric 7 required the most pressing after both cleaning processes. Fabric 10 required very little care. All four fabrics of the group needed more pressing after dry cleaning than after laundering.

Light Reflectance Changes Following Laundering and Dry Cleaning

Whiteness retention in glass curtain fabrics is of concern to the consumer. The resins used for treatment of synthetic fibers for crease resistance are believed to attract soil and soap particles. This redeposition of soil and soap particles causes discoloration of the fabric and lessens the percentage of light reflectance. In most cases the whiter the fabric the greater the percentage of light reflectance if the textures of the surfaces of the fabrics are similar.

All fabrics used for this study with the exception of Fabrics 8 and 10, were white in the original state. Fabric 8, a novelty Dacron fabric, was beige, and Fabric 10, a novelty Fiberglas fabric, green in color.

For this study, changes in light reflectance of less than five percent were considered relatively little changes and not objectionable. Changes of more than five but less than ten percent were considered definite changes, and, if they occurred as losses, objectionable and undesirable.

The percentage light reflectance of the original fabrics is given in Table V. The percentage difference in light reflectance after laundering and dry cleaning is given in Table V and presented graphically in Illustration V.

Sheer Marquisette Fabrics. Of the sheer marquisette fabrics, Fabric 1 had the greatest original percentage of light reflectance and increased after each cleaning process. Fabric 2 lost 1.4 percent and Fabric 3 gained 1.0 percent. Both fabrics gained reflectance after the fifth dry cleaning.

Ninon Fabrics. Of the ninon fabrics, Fabric 5, Arnel, had the highest percentage of light reflectance and increased in reflectance after the fifth laundering but decreased after the fifth dry cleaning. Fabrics 4 and 6 had the same original percentage of reflectance, but Fabric 4, rayon, increased more in reflectance after both cleaning processes. That of Fabric 6, Dacron, decreased after both processes. Of the two fabrics that increased in reflectance, more gain occurred after laundering than after dry cleaning. Fabric 6 lost more reflectance after laundering than after dry cleaning.

Novelty Fabrics. Both of the white novelty fabrics, Fabric 7 and 9, decreased in reflectance after the fifth laundering. Fabric 7 increased after the fifth dry cleaning but Fabric 9 decreased two percent from its original reflectance.

TABLE V

PERCENTAGE OF LIGHT REFLECTANCE BEFORE AND AFTER LAUNDERING AND DRY CLEANING

Fabric Number	Original Percent	Number of Times Laundered			
		One		Five	
		Percent	Percentage Difference	Percent	Percentage Difference
1	51.4	61.3	+ 9.9	60.4	+9.0
2	37.7	48.2	+10.5	36.3	-1.4
3	35.4	55.0	+19.6	36.4	+1.0
4	65.0	64.1	- 0.9	67.7	+2.7
5	69.7	62.6	- 7.1	71.2	+1.5
6	65.0	55.9	- 9.1	51.3	-3.7
7	57.3	61.1	+ 3.8	55.7	-1.6
8	62.3	58.5	- 3.8	64.8	+2.5
9	65.4	65.8	+ 0.4	61.6	-3.8
10	40.9	42.9	+ 2.0	45.9	+5.0
		Number of Times Dry Cleaned			
1		51.5	+ 0.1	53.7	+2.3
2		37.3	- 0.4	38.1	+0.4
3		38.0	+ 2.6	37.7	+2.3
4		65.7	+ 0.7	67.1	+2.1
5		69.2	+ 0.5	68.2	-1.5
6		64.6	- 0.4	64.0	-1.0
7		61.4	+ 4.1	62.4	+5.1
8		60.1	- 2.2	55.1	-7.2
9		65.4	± 0.0	63.3	-2.1
10		45.3	+ 4.4	46.8	+5.9

ILLUSTRATION V

PERCENTAGE DIFFERENCE IN LIGHT REFLECTANCE AFTER LAUNDERING AND DRY CLEANING

SHEER MARQUISETTE FABRICS

After laundering ▲ ————————
After dry cleaning △ - - - - - -

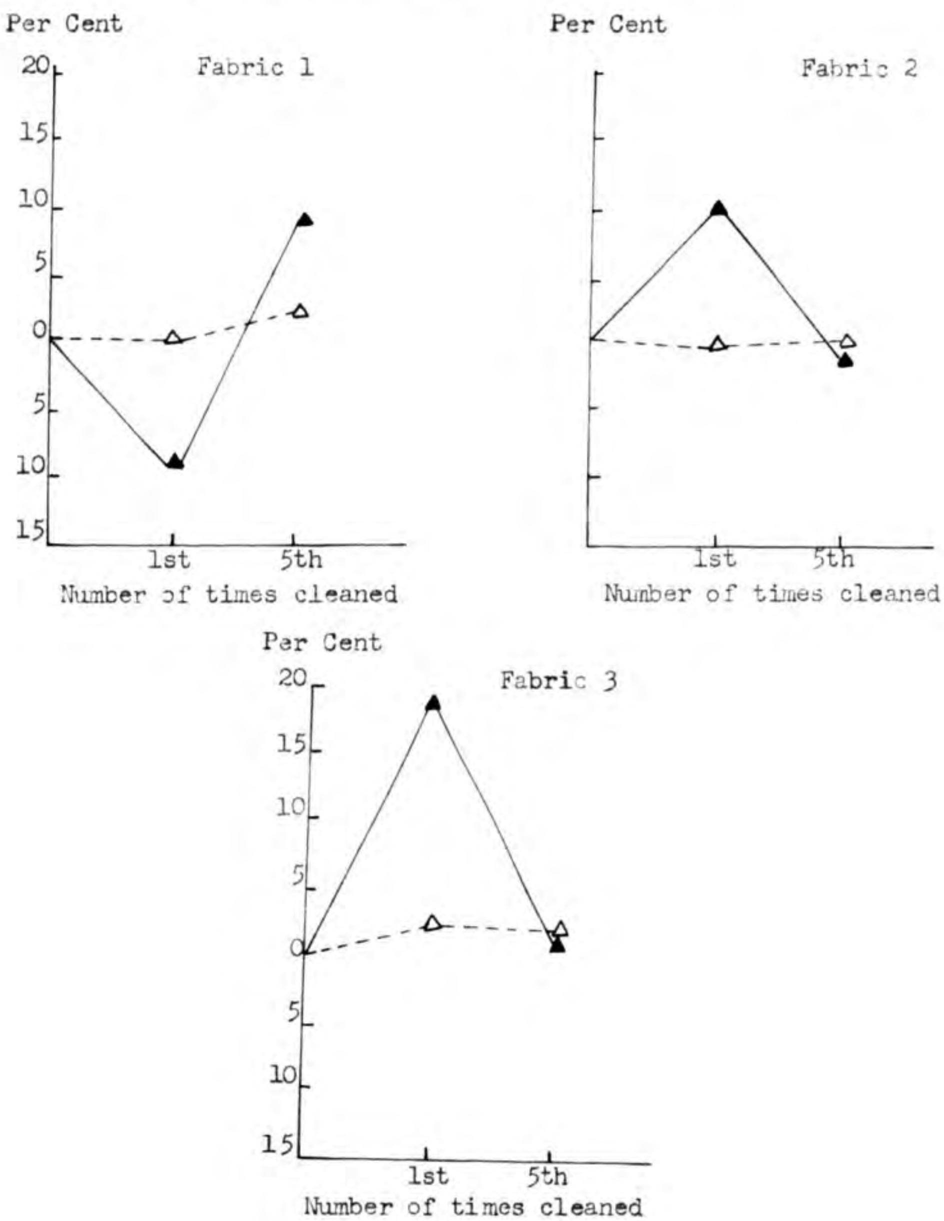
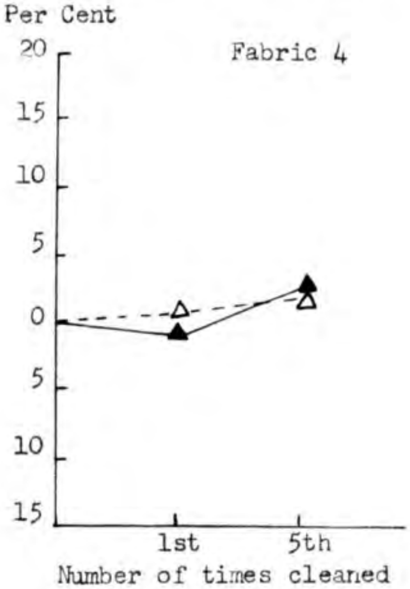


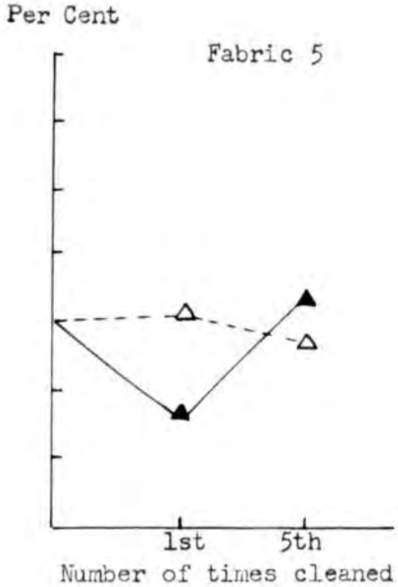
ILLUSTRATION V (continued)

PERCENTAGE DIFFERENCE IN LIGHT REFLECTANCE AFTER LAUNDERING AND DRY CLEANING

NINON FABRICS

After laundering ▲ ————
After dry cleaning △ - - - - - -





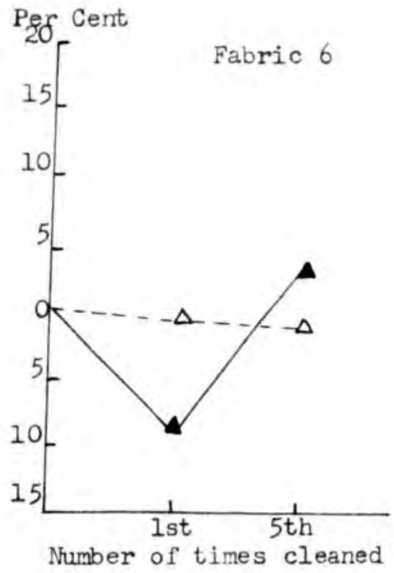
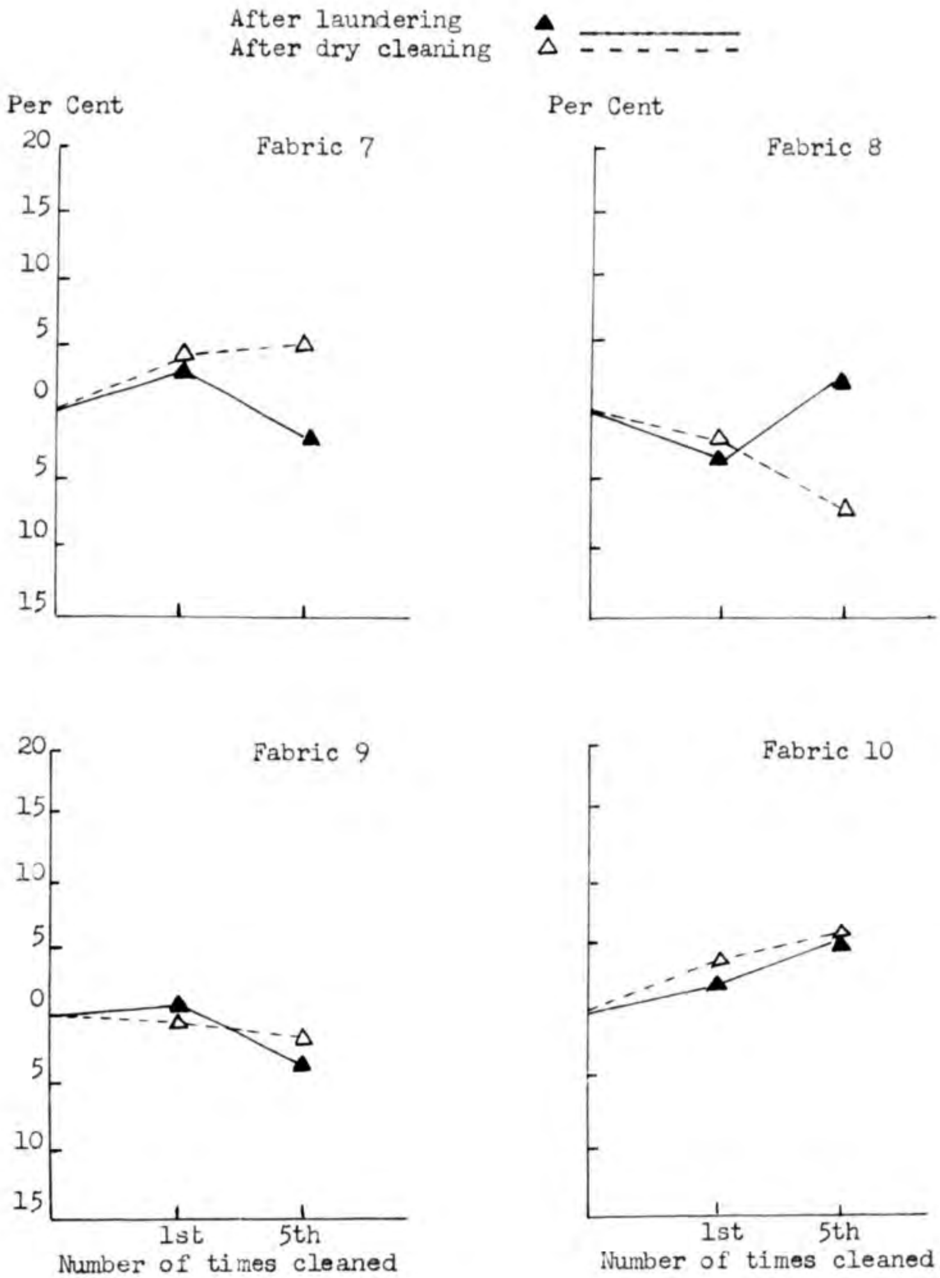


ILLUSTRATION V (continued)

PERCENTAGE DIFFERENCE IN LIGHT REFLECTANCE AFTER LAUNDERING
AND DRY CLEANING

NOVELTY FABRICS



Of the two colored fabrics, Fabric 8, the beige Dacron fabric, had the greater reflectance. After laundering, both fabrics gained from 2.5 to 5.0 percent. This gain could have been due to noticeable fading that occurred in the fabrics during the cleaning processes. After the fifth dry cleaning, Fabric 8 lost 7.2 percent of its original reflectance but Fabric 10 gained 0.9 percent more reflectance than after the fifth laundering. Fading was more evident in Fabric 10 after dry cleaning than after laundering. Less color change occurred in Fabric 8. After the fifth laundering the only fabrics of all ten fabrics used for this study having changes that exceeded five percent were Fabrics 1 and 10. The gain of nine percent in Fabric 1 was possibly due to loss of sizing during the cleaning process. The gain of five percent in Fabric 10 was possibly due to fading of color in the cleaning process. After the fifth dry cleaning, only Fabrics 7, 8 and 10 had changes that exceeded five percent. Fabric 7 had an increase of 5.1 percent due to the loss of sizing and an evident increase in luster of the filling yarns. The loss of 7.2 percent reflectance in Fabric 8 was possibly due to redeposition of soil or soap particles. The increase of 5.9 percent in Fabric 10 was possibly due to fading during the cleaning process.

Of all fabrics having reflectance changes of less than five percent, more losses occurred after laundering than after the dry cleaning process. Of the fabrics having changes that exceeded five percent, the only loss occurred in Fabric 8 after the fifth dry cleaning process.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER STUDY

Curtain fabrics made of various synthetic fabrics are currently on the market, but very little information about their serviceability features is available. The consumer needs to know the proper care procedures necessary to retain the original properties of the fabrics. Detailed information such as whether to launder by hand, by machine or to dry clean, correct water temperatures, the length of time required for machine washing, the degree of color fastness and whether to use soap or detergent as well as proper ironing procedures would help the consumer care for her curtain fabrics more wisely. Very few yard goods labels give any of the above information. With the exception of advertisements which tend to give only the advantageous points, the consumer has no basis for determining how the fabrics will perform.

This study was planned to determine any similarities or differences in the construction of and the performance features of curtain fabrics of synthetic fibers. The tests used to determine these features consisted of laboratory analysis of fabric construction, dimensional change, breaking strength, crease resistance and light reflectance. These tests were performed on the fabrics in the original state and after the first and fifth laundering and dry cleaning.

The fabrics used for the study were limited to those sheer glass curtain fabrics that could be purchased in the vicinity of Greensboro. Three sheer marquisette fabrics, three ninon fabrics, and four novelty fabrics of eight different fibers were selected for the study. A variety of fabrics was used purposely to determine any similarities and differences that might occur.

According to laboratory analysis of fabric construction, only one blended fabric, a Fortisan and acetate blend, was used. All fabrics used were constructed with either a plain or leno weave.

The following similarities and differences were noted in the sheer marquisette and ninon fabrics. The average thickness of each group of fabrics ranged from .006 to .009 inches. The majority of the fabrics fell within a weight range of from 1.0 to 1.8 ounces per square yard. The two groups differed in thread count. The plain weave ninon fabrics averaged a greater number of threads per inch. With the exception of Fabric 1, the rayon marquisette, the denier of the yarns of the two groups fell within a range of from 58.35 to 67.08 in the warp yarns and from 54.61 to 62.53 in the filling yarns. The ninon fabrics had higher twist count.

The novelty fabrics differed greatly from the sheer marquisette and ninon fabrics in weight and fabric thickness. With the exception of Fabric 7, the Fortisan and acetate blend, the thread count ranged from 28 to 52 in the warp and from 17 to 28 in the filling. Two of the novelty fabrics contained yarns constructed with staple fiber.

In respect to dimensional change after laundering and dry cleaning, the rayon marquisette had the most excessive dimensional change of all the fabrics. The Fiberglas novelty fabric was the only fabric having no more than the acceptable two percent dimensional change in both warp and filling directions when laundered and dry cleaned five times. The Dacron and viscose novelty fabric and the Fiberglas novelty fabric were the only fabrics having no more than the acceptable dimensional change in both warp and filling direction when dry cleaned five times. The nylon marquisette and the Fiberglas novelty fabric were the only fabrics having no more than the acceptable change when laundered five times. With the exception of the rayon marquisette and the Fiberglass novelty fabric, less shrinkage occurred in all the fabrics after dry cleaning five times than after laundering five times.

According to laboratory testing of breaking strength after five launderings and dry cleanings, the rayon marquisette lost the most strength after cleaning. Three of the fabrics having Dacron fiber content showed the greatest gains in breaking strength after cleaning. This gain was possibly due to fusing of the fibers during pressing. With the exception of the rayon marquisette and the Fiberglas novelty fabric, all the fabrics lost less strength following the fifth dry cleaning than after the fifth laundering. Of the novelty fabrics the Dacron and viscose novelty fabric could be expected to wear longer after cleaning.

Crease resistance tests which were used to determine which fabrics would require the least amount of pressing after cleaning showed the following results. After laundering five times, the nylon and Dacron marquisettes, the rayon ninon, the Dacron and cotton novelty fabric and the Fiberglas novelty fabric generally lost more crease resistance than after the fifth dry cleaning. The rayon marquisette, the Arnel ninon, the Dacron ninon, the Dacron and viscose novelty fabric and the Fortisan acetate novelty fabric generally retained more crease resistance after the fifth dry cleaning.

Tests for light reflectance revealed that after the fifth laundering the only fabrics having changes exceeding the acceptable five percent were the rayon marquisette and the Fiberglas novelty fabric. Following the fifth dry cleaning the Dacron and viscose novelty fabric decreased more than the five percent and the Fiberglas novelty fabric increased more than five percent. Loss of sizing and apparent fading were the possible causes of increased light reflectance. Following the fifth dry cleaning, less change in the reflectance occurred in the rayon marquisette, the rayon ninon, the Arnel ninon, and the Dacron ninon, and the Dacron and viscose novelty fabric. Decreases from the original light reflectance occurred following the fifth dry cleaning in the Arnel ninon, the Dacron ninon, the Dacron and viscose novelty fabric, and the Dacron and cotton novelty fabric. Decreases following the fifth laundering occurred in the nylon marquisette, the Fortisan and acetate blend and the Dacron and cotton novelty fabric.

CONCLUSIONS

The following conclusions were drawn from the study:

1. The consumer needs more detailed information about synthetic curtain fabrics because of the many differences that occur in construction and fiber content as well as in response to laundering and dry cleaning.

2. The Monsanto crease recovery test was not the best method to use for determining changes in the body texture and drapability of the fabric. If the equipment had been available, the test for drapability would have helped determine what care would be needed to restore the

fabrics to their original appearance.

3. The amount of dimensional change to be expected of each fabric should be known before the consumer purchases a curtain fabric. A shrinkage exceeding five percent would be an expensive loss.

4. There was so much variability in response to laundering and dry cleaning tests that it would not be advisable to publish any results of this study for consumer use. Further study using a number of samples of the same type fabric would be necessary.

5. The Fiberglas novelty fabric was the only fabric having no more than the acceptable two percent dimensional change in both warp and filling direction when laundered and dry cleaned five times. The novelty Dacron and viscose fabric could be dry cleaned five times without objectionable dimensional change. The nylon marquisette would be expected to launder satisfactorily five times.

6. With the exception of the rayon marquisette and the Fiberglas novelty fabric, all the fabrics lost less strength after the fifth dry cleaning than after the fifth laundering.

7. The fabrics that did not have original crease resistance of the acceptable 125 degrees were the rayon marquisette, the Dacron ninon, and the Fortisan and acetate novelty fabric. These fabrics would be expected to require more pressing after laundering and dry cleaning.

8. The fabrics which retained crease resistance most satisfactorily following laundering were the nylon marquisette, the Dacron marquisette, the rayon ninon, the Dacron and cotton novelty fabric and the Fiberglas novelty marquisette. The remaining fabrics required less pressing after the dry cleaning process.

9. Fewer changes in light reflectance occurred following the fifth laundering than after the fifth dry cleaning.

RECOMMENDATIONS FOR FURTHER STUDY

The following recommendations are suggested for further study:

1. To determine the effect of soaps and detergents used in home laundering upon whiteness retention of the fabrics.

2. To determine the effect of sunlight upon strength and whiteness retention of the fabrics.

3. To determine the effect of exposure in the Fade-Ometer upon strength and whiteness retention of the fabrics.

4. To continue the study of various additional fabrics of similar construction and fiber content with tests for evaluation of dimensional change, breaking and bursting strength, drapability and light reflectance.

5. To compare the serviceability in use by wear studies of curtains made from fabrics of similar construction and fiber content.

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