EFFECTS OF DRYCLEANING AND EXPOSURE TO LIGHT ON SELECTED SERVICE QUALITIES OF TWO MALIMO DRAPERY FABRICS

by

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CHAPTER I

INTRODUCTION

During the past few years, the "stitch-through" process of forming fabric has aroused a great deal of interest. It is a totally new area of fabric manufacturing that does not duplicate woven or knit constructions. This process lends itself to the formation of fabrics never before possible combining the best characteristics of knitting and weaving. The "stitch-through" process has been on the consumer market for such a short period of time that little research is available. Mali, the name given to one type of "stitch-through" process, includes three machines; Malimo, Malipol, and Maliwatt. Malimo is the basic Mali machine. Therefore, certain service qualities of Malimo drapery fabrics were chosen for analytical study in this research project.

The first commercial Malimo machines were brought to the United States and distributed by Crompton & Knowles-Malimo Inc. Introduction of the first Malimo products was made in the spring of 1965 (Mikton, 16). Werner (25) predicted that "stitch-through" products should have a considerable impact on the market by spring or fall, 1968.

Malimo fabrics are being tested by the Materials and Goods Testing House in East Germany and by various fabric manufacturers in the United States such as Burlington Nexus and M. Lowenstein & Co. Little work was found in the literature concerning the research that is being done by these companies. Bahlo (23), of Crompton & Knowles-Malimo Inc. in a recent communication stated that each company producing Malimo fabrics is setting up its own standards for these fabrics and conducting research, but their procedures and results are not available at this time. He also stated that all of the Malimo fabrics have stood up well under intensive testing. An article that appeared in the May 27, 1968 issue of Daily News Record stated that the Mali structure gives higher strength per pound and greater tear resistance than woven fabrics (Whittaker, 26).

Since little information is available on the studies being conducted in other laboratories, mostly in industry, it seemed appropriate to study the Mali fabrics. The objective of the proposed study was to evaluate some of the service qualities of two Malimo drapery fabrics currently on the market. The specific factors studied were the effects of:

1. drycleaning on dimensional stability
2. drycleaning on the bursting strength
3. light on the bursting strength
4. both light and drycleaning on the bursting strength.

CHAPTER II

REVIEW OF LITERATURE

Construction

The idea of producing fabrics by stitching the warp and filling yarns together and transposing the production speed of the sewing machine into fabric production originated early in 1947. The first Mali machine developed in 1952 produced fabrics twenty-seven inches wide. The first full width machine appeared in 1958. During the years of 1952 through 1958, narrow towelings, bandages, and other crude industrial fabrics were produced.

The Mali concept is based on locking together either yarns or a web of fibers with the use of needles and thread. This avoids the interlacing of yarns as in weaving. The Mali principle usually uses a three yarn system; warp, filling, and stitching threads. It is possible to use either the warp or filling and a stitching thread.

Malimo, the basic machine, has a needle gauge range from three to eighteen needles per inch. With this range, a varied assortment of textile materials can be produced. The density of the fabrics are affected greatly when using a two yarn system instead of a three yarn system. The main difference between these two systems is that the warp yarns are connected to the filling yarns with a zig-zag stitch, whereas a straight stitch is used when the warp or filling yarn is omitted (Ponitz, 19). In the two yarn system, the stitching thread acts as a warp causing the fabrics to have stretch in the warp direction. It is not difficult to see why the sewing yarn is the most critical from a quality and efficiency standpoint (Provost, 20).

Draperies, tablecloths, sportshirts, men's and women's suiting fabric, linings, automobile upholstery, and industrial fabrics have been made on the Malimo machine. Variety can be achieved by: (1) changing the number of ends of warp or filling, (2) introducing colored yarns in the warp or filling, (3) using novelty yarns, (4) changing the length of the stitch, (5) changing the stitch characteristics, (6) using intermittent speeds, and (7) changing the gauge of the machines (Scattergood, 22).

The Malipol machine, a variation of the Malimo, produces a fabric by stitching around a pile sinker and into a ground fabric. The backing fabric takes the place of the warp and filling yarns (Mauersberger, 15). The backing fabric can be a woven, knitted, Malimo cloth, or a foam-backed fabric (Ponitz, 19). Variety can be obtained by: (1) the use of different sized pile sinkers, (2) using colored yarns to create stripes, (3) using different gauges, (4) using novelty yarns, (5) cutting the pile, and (6) napping either or both sides of the fabric. Some of the fabrics produced are blankets, inexpensive floor coverings, automobile carpets, outerwear, imitation fur, and upholstery (Mauersberger, 15).

Maliwatt is the machine used for stitching fiber webs. A nonwoven batting is substituted for the warp and filling. The batting is stitched together with the interlocking tricot stitch. The stitching needles pierce the web, grasp a bundle of fibers, and use them as a stitching yarn. By this process, the fibers are forming the face of the fabric and also the stitching yarn. Different effects can be obtained by:

(1) varying the length of stitch, (2) using either one or two stitching bars, (3) changing the gauge, (4) changing the consistency of thickness of the batt or web, and (5) using a different type of stitch (Provost, 20). Maliwatt fabrics are being used for apparel, shoe liners, carpet backing, insulation material, blankets, interlining, and automotive liners (Bhalo, 2).

The three Mali machines are extremely variable and versatile. There is hardly a branch of industry where they cannot be utilized. Several countries, including the United States, have been studying and experimenting with the Mali process. Mali fabrics can be made at twenty times the speed of a loom with functional characteristics superior to woven fabrics with higher strength, better drapability, and cleanability. They have characteristics of a knit along with the stability and tailoring qualities of a woven product (Bhalo, 2).

Fibers

Today, an ever-increasing number of different fibers are being used in fabrics for both wearing apparel and household items. Fibers are classified as natural and man-made. Natural fibers are classified as either cellulosic or protein. Man-made fibers are grouped in sixteen generic classifications. Only those fibers that make up the fabrics used in this study will be discussed.

Cotton

Cotton, a natural cellulose fiber, is the most widely used fiber in the world. From 1500 B.C. to A.D. 1500, India was the center of the cotton industry. Pima Indians were growing cotton in the United States when the Spaniards arrived. The invention of the spinning jenny and the spinning frame made England the center of cotton manufacturing in 1769. Manufacturing costs and competition forced the cotton industry to move to North and South Carolina after World War II. A milder climate, lower taxes and fewer labor restrictions gave the South an advantage in the cotton industry. Cotton growing then shifted to the Southwest and Far West where it could be irrigated and less affected by changing weather conditions. Today, cotton grows in any part of the world where the growing season is long (Hollen and Sadler, 8).

Cotton has many comfort characteristics, can be blended with other fibers, and is easily washed. It has a medium tensile strength which increases by approximately thirty per cent when wet. Cotton's low resiliency can be improved with durable press finishes. Mercerization improves the luster of cotton. Due to the moderate resistance of cotton to sunlight, draperies should be lined. Chemically, cotton is harmed by mineral acids, but is little affected by organic acids. Cotton is attacked by mildew but is generally resistant to moths.

Rayon

Glucose, which is composed of carbon, hydrogen, and oxygen, forms the basic unit of the cellulose molecule. The number of glucose molecules in the cellulose chain depends on the origin of the cellulose. Natural and regenerated cellulose chains differ in length. The longer chains being the strongest. Rayon, a man-made or regenerated cellulose fiber is made by dissolving and resolidifying natural cellulose (Leeming, 11).

The most successful method of making rayon was developed by Cross and Bevan, two English chemists. They discovered that by treating cellulose with caustic soda, the fiber swelled and was converted into an entirely new compound when treated with carbon bisulfide. This compound became a straw-colored viscous solution when dissolved in water or a dilute caustic soda solution. Cross and Bevan secured a patent for this process in 1892. The viscose solution was pumped through the tiny holes in a spinneret and into an acid spinning bath. When lightly twisted together, the group of filaments from one spinneret form the rayon yarn (Leeming, 11).

Rayon has a low wet tenacity, low elastic recovery, and low resiliency. It requires finishes to produce adequate recovery from undesirable creasing and wrinkling. Rayon absorbs more moisture than natural cellulosic fibers. Exposure to high temperatures for an extended period of time results in fiber degradation. Strong alkali solutions cause rayon fibers to swell and eventually produce a loss in strength. Chemically, rayon is sensitive to hot and cold concentrated acids. It has good resistance to aging and insects except silverfish. It is used extensively in apparel and home furnishings fabrics (Linton, 12).

Polyester

Polyethylene terephthalate, the only polyester of commercial significance in 1930, was the basis of much research by Carothers. His research was seriously delayed by World War II. DuPont's polyester fiber became available on an experimental basis in 1950 and available commercially in 1953. It was first sold under DuPont's registered trademark Dacron. The first polyester fiber had excellent wrinkle recovery both wet and dry and found immediate acceptance in easy-care, wash-and-wear, and durable press garments.

Polyester fibers possess high strength, good resistance to abrasion, low moisture absorption and high recovery from low elongation. Under conditions of high atmospheric humidity and body perspiration, polyester fibers do not shrink and are resistant to wrinkling. The wet strength is comparable to the dry strength. Static electricity builds up causing dust and dirt to be attracted to the surface. Antistatic finishes are applied to fabrics containing polyester fibers at the factory, but they frequently wash out or are removed in drycleaning. Polyester fibers generally are resistant to both acids and alkalies and can be bleached with cotton type bleaches. They are resistant to biological attack and to sunlight damage. Polyester fibers are well suited for broad uses in home furnishings and industrial fields.

Modacrylic

Modacrylic is produced by dissolving the raw material, a copolymer resin, in acetone. The fiber is stretched, crimped, cut, and stabilized by heat-setting. Stretching is done to orient the molecules thus increasing the fiber strength. Modacrylic is heat sensitive causing it to have limited use in clothing. It will not support combustion and has excellent resistance to abrasion. Modacrylic has excellent resistance to acids, alkalies, moths, mildew, and chemicals. Warmth without weight is one of the outstanding characteristics of modacrylic fibers.

Drycleaning

Martin and Fulton (14) defined drycleaning as the cleansing of textiles in an organic solvent. Solvents have been used as drycleaning fluids since the middle of the 19th Century. A drycleaning solvent should not soften the fibers, cause shrinkage, or bleeding of dyestuffs. Perchloroethylene and Stoddard solvent are the most common drycleaning solvents in use today.

The finishing of textiles refers to those final processes that determine the character of the product. A large number of interrelated factors such as the structure of the garment, the fabric and its yarns and the properties of the basic fiber, determine the character. Any extensive change in the character of the structure means that deterioration has occurred. Structural changes that can occur and be reversed within limits are shrinkage, swelling, stretching, and wrinkling. The degree that these changes occur and the extent of their reversibility depends on the physical properties of the fiber and the structure of the yarns and fabrics. One of the main problems faced by the dry cleaner has been maintaining the original dimensions of the garment. Shrinkage and swelling generally are caused by the effect of water, whereas creasing and stretching result from mechanical stresses (Martin and Fulton, 14).

Textile shrinkage can occur through felting or relaxation of strains. Felting, a phenomenon peculiar to the hair fibers, does not normally occur during drycleaning. The second type of shrinkage is a reversible process that can occur at three levels; fabric, yarn, and fiber. According to Marsh (13), the total shrinkage is the resultant of shrinkage at these three levels. In general, in cotton fabrics the shrinkage occurs at the fabric level. Rayon fabrics have shown more shrinkage at the fiber and yarn levels. Fulton and Martin (14), reported that the contribution of fiber shrinkage to the over-all fabric shrinkage is minor except in fibers like acetate and viscose rayon. The low elastic limits of these two fibers can lead to a permanent set when a considerable stress is applied. This process is evident in some rayon fabrics which change in dimensions because of a change in the relative humidity of the air.

Coin-operated drycleaning was introduced in 1959. Tests run by the National Institute of Drycleaning indicated that the coin-operated machines generally do a satisfactory job of removing dirt (Kiplinger, 10). A solvent mixture bathes the articles as they tumble in a rotating drum. The solvent is then drawn off and air is forced into the moving drum to evaporate any remaining liquid. Housewives have used coin-operated drycleaning for drapes, blankets, and sweaters. The average customer used these facilities once every two or three months (Bell, 3).

Perchloroethylene, the solvent used in coin-operated drycleaning, will stiffen plastic coated items and cause rubber to lose its elasticity. It will dissolve the natural oils that keep leather and furs supple. Regular suede will dry out, and imitation suede may shrink or harden. The tumbling action could tear draperies that have been weakened by long use and exposure to light (Kiplinger, 10).

Light

Fabrics for both indoor and outdoor use need good light resistance even though they may be partially protected from sunlight. Fabrics used for draperies or curtains represent the textile material receiving more exposure to light than any other commonly used by the average consumer. According to Pomroy (18), ten per cent of all the complaints of fabric malperformance involve light damage to drapery fabrics.

Ultraviolet rays with wave lengths from 290 to 400 millimicrons are the primary cause for radiation damage to fibers. Pomroy (18) defined deterioration as a loss of some physical property. Bush (5), stated that sunlight usually produces a change in the surface appearance but the change may be an invisible one such as loss of tensile strength, hardness or resilience. According to Bringardner et al. (4), the characteristics most likely to influence light resistance are: (1) chemical composition and internal structure of the fiber, (2) colored pigments, delustrants, and other additives or impurities in the polymer, (3) size or thickness of the fiber structure, and (4) dyes, finishes, ultraviolet absorbers.

All natural and man-made fibers are degraded by exposure to sunlight and radiation from other sources. Robinson (21), found that light and heat degrade cotton. In working with the Weather-Ometer, he found that temperature has much more of an effect on both fabric and dyes than an increase in relative humidity. Bringardner et al. (4), in a recent study, found that after thirty-two months of direct exposure to sunlight that polyester fibers retained more than twenty per cent of their original strength whereas viscose rayon retained only four per cent and cotton two per cent of their original strength. After a twelve month exposure, Pomroy (18), found that cotton retained seventy-eight per cent of its original strength and rayon retained thirty per cent.

Specimens can be exposed in the laboratory in a Weather-Ometer to the light of a carbon-arc lamp. This produces an accelerated test for light resistance. The carbon-arc lamp emits larger proportions of ultraviolet radiation particularily in longer wave lengths, and produces a large amount of fiber damage (Bringardner et al., 4).

CHAPTER III

METHOD OF PROCEDURE

Selection of Fabrics

Two Malimo drapery fabrics of similar construction but of different fiber content were selected from the open market. The main criteria for selecting these fabrics was availability and fiber content. The fabrics were analyzed as purchased and after they had been exposed in the Weather-Ometer, model 18-WR, and drycleaned according to the methods specified by the American Association of Textile Chemists and Colorists, 1968 (24) and the American Society for Testing Materials, Committee D-13, 1968 (6).

The fabrics were labeled dry clean only and were of the following fiber contents:

(I) 92 per cent cotton
8 per cent polyester

(II) 67 per cent Verel modacrylic
28 per cent viscose rayon
5 per cent other fibers

Plate I, page 15, shows samples of the two fabrics. A coding system was developed to designate the treatment the fabric was to be given. The codes were as follows:

Fabrics	I and II
Exposures	1 = unexposed 2 = 80 hours 3 = 160 hours

EXPLANATION OF PLATE I

Fig. 1 Fabric I

Fig. 2 Fabric II

PLATE I

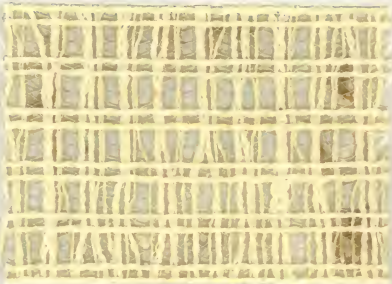

Fig. 1

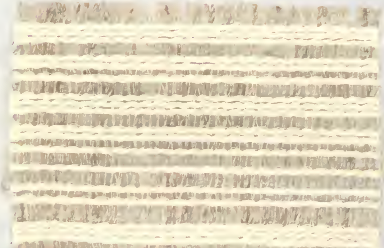

Fig. 2

Drycleanings	1 = before drycleaning 2 = 1 drycleaning 3 = 2 drycleanings
Specimens	1, 2, 3, 4, and 5

For example I-1-1-1, refers to fabric I, 1-unexposed, 1-before drycleaning, and specimen-1. Plate II, page 18, shows the plan followed in cutting the fabric specimens.

Experimental Procedures

Fabric specimens were exposed for eighty and one hundred sixty hours in the Weather-Ometer to measure the resistance of the two Malimo fabrics to degradation under radiant energy exposure conditions without wetting. Two exposure periods were selected for this study since a standard has not been determined for Malimo drapery fabrics (A.A.T.C.C., 24). The back side of the fabrics was exposed. The black panel thermometer inside the Weather-Ometer was controlled by a thermostat set at 140 F. After exposure the specimens were transferred to a standard conditioned atmosphere and allowed to condition for twenty-four hours before being subjected to further testing. The specimens to be drycleaned were put in a coin-operated drycleaning unit in a perchloroethylene solvent for thirty minutes. The specimens used to study the interaction of light and drycleaning were first exposed to light and then drycleaned. The Scott Constant-Rate-of Extension Tensile Testing Machine (CRE) was used to determine the bursting strength of the specimens. Elongation was automatically recorded by the CRE when determining bursting strength and was calculated in per cent. The specimens used to measure dimensional

EXPLANATION OF PLATE II

Plan for cutting test specimens

Code: DS = Dimensional Stability
1-1 = before treatment
1-2 = unexposed, 1 drycleaning
1-3 = unexposed, 2 drycleanings
2-1 = 80 hours of exposure, before drycleaning
2-2 = 80 hours of exposure, 1 drycleaning
2-3 = 80 hours of exposure, 2 drycleanings
3-1 = 160 hours of exposure, before drycleaning
3-2 = 160 hours of exposure, 1 drycleaning
3-3 = 160 hours of exposure, 2 drycleanings

PLATE II

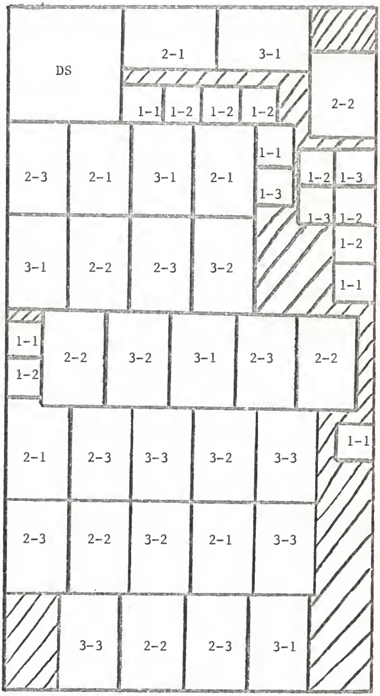

Fig. 3

stability were conditioned in a standard atmosphere, marked with a laundry pen, drycleaned, pressed at 250 F., conditioned, and measured for dimensional change.

Analysis of Data

Three Way Analysis of Variance

A three way analysis of variance was done to show if the two fabrics gave similar results. The fixed variables analyzed were: fabric (two factors), exposure (three factors), and drycleaning (three factors). All of the values analyzed were means of fifteen determinations. All significance was determined at the five per cent level.

Two Way Analysis of Variance

A two way analysis of variance was done to study the effects of drycleaning, light, and the interaction of light and drycleaning on the bursting strength of each fabric. The fixed variables analyzed were: exposure (three factors) and drycleaning (three factors). All significant difference was determined at the five per cent level of probability.

CHAPTER IV

RESULTS AND DISCUSSION

The effect of drycleaning on the dimensional stability of each fabric was studied. The effects of drycleaning, light, and the interaction of light and drycleaning on the bursting strength also was studied. By doing bursting strength on the fabrics before and after exposure to light and to drycleaning, a pattern of breakdown in strength was observed for each Malimo fabric.

Dimensional Stability

Fabric I shrank 2.3 per cent in the warp yarns and 3.3 per cent in the filling yarns after one drycleaning. The total shrinkage after two drycleanings was 4.0 per cent in the warp yarns and 5.0 per cent in the filling yarns.

Fabric II shrank 1.7 per cent in both warp and filling after one drycleaning. The total shrinkage after two drycleanings was 2.3 per cent in both the warp and filling yarns.

Bursting Strength and Elongation

Fabric I (Fig. 4, page 21)

Bursting strength after one drycleaning increased 6.9 pounds over the bursting strength before drycleaning. After a second drycleaning, bursting strength decreased 1.1 pounds from bursting strength after one drycleaning. Bursting strength decreased after each exposure period.

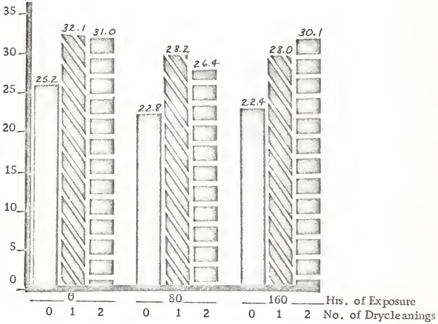

FIGURE 4

Changes in Bursting Strength of Fabric I Before and After Drycleaning, Exposure, and the Interaction of Exposure and Drycleaning

After eighty hours of exposure, bursting strength decreased 3.4 pounds and an additional 0.4 pounds after one hundred sixty hours of exposure. Bursting strength after eighty hours of exposure and one drycleaning increased 5.4 pounds over bursting strength after eighty hours of exposure. With the addition of a second drycleaning, bursting strength decreased by 1.8 pounds. After one hundred sixty hours of exposure and one drycleaning, bursting strength increased by 5.6 pounds over bursting strength after one hundred sixty hours and increased an additional 2.1 pounds with the addition of a second drycleaning. Elongation (Table I) remained at fifteen per cent for all three exposures, and increased slightly with each drycleaning.

TABLE I

PERCENTAGE OF ELONGATION OF FABRIC I AND FABRIC II

Treatment	Elongation (per cent)	
	Fabric I	Fabric II
Before treatment	15.0	20.2
1 drycleaning	19.5	19.5
2 drycleanings	18.7	17.2
80 hrs. of exposure	15.0	20.7
160 hrs. of exposure	15.0	22.5
80 hrs. and 1 drycleaning	21.7	18.0
80 hrs. and 2 drycleanings	18.0	16.5
160 hrs. and 1 drycleaning	16.5	15.0
160 hrs. and 2 drycleanings	17.2	15.7

Fabric II (Fig. 5, page 24)

Compared to the bursting strength before drycleaning, bursting strength after one drycleaning increased 0.7 pounds and decreased 3.4 pounds after a second drycleaning. Bursting strength decreased after each exposure period with the largest decrease occurring after eighty hours of exposure. Bursting strength decreased 7.3 pounds after eighty hours of exposure and an additional 0.6 pounds after one hundred sixty hours of exposure. After eighty hours of exposure and one drycleaning, bursting strength increased by 12.6 pounds over bursting strength after eighty hours of exposure and decreased 6.0 pounds with the addition of a second drycleaning. Compared to bursting strength after one hundred sixty hours of exposure, bursting strength increased 4.5 pounds after one hundred sixty hours of exposure and one drycleaning and decreased 6.3 pounds with the addition of a second drycleaning. Elongation (Table I, page 22) decreased slightly with each drycleaning, and increased slightly with each exposure.

Three Way Analysis of Variance

There was significant difference between the two Malimo drapery fabrics (Table II, Appendix, p. 33). Variance was highest for fabric II and lowest for fabric I. Significant differences occurred between fabric before drycleaning and one drycleaning, fabric before drycleaning and two drycleanings, but there was no significant difference between one and two drycleanings (Table III, Appendix, p. 33). Variance for fabric before drycleaning and one drycleaning was about the same. Two drycleanings had

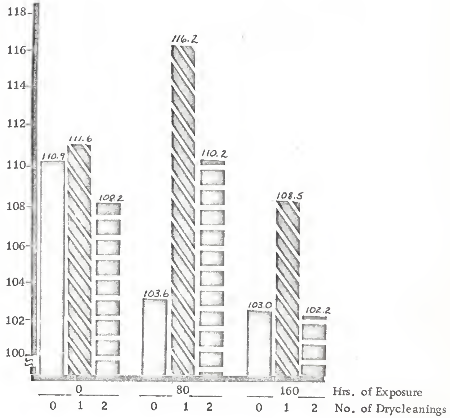

FIGURE 5

Changes in Bursting Strength of Fabric II
Before and After Drycleaning, Exposure, and
the Interaction of Exposure and Drycleaning

the lowest variance. Exposure did not have a significant effect on the two fabrics at the five per cent level (Table IV, Appendix, p. 33). Variance was highest for eighty hours and lowest for one hundred sixty hours. There were no significant differences between the interaction of light and drycleaning on the two Malimo drapery fabrics.

Two Way Analysis of Variance

A two way analysis of variance was done to study the effects of drycleaning, light, and the interaction of light and drycleaning on the bursting strength of each fabric.

Fabric I

Drycleaning (Table V, Appendix, p. 34). There were significant differences between fabric before drycleaning and one drycleaning and before drycleaning and two drycleanings. There was no significant difference between one and two drycleanings. Variance was highest for two drycleanings and lowest for fabric before drycleaning.

Exposure (Table VI, Appendix, p. 34). Significant differences occurred between the unexposed fabric and fabric exposed for eighty hours, and between the unexposed fabric and fabric exposed for one hundred sixty hours. There was no significant difference between eighty and one hundred sixty hours of exposure. Variance was highest for the unexposed fabric and lowest for the fabric exposed for one hundred sixty hours. For all three exposures, the polyester stitching yarn broke first, the filling yarn second, and the warp yarns last.

Drycleaning x Exposure (Table VII, Appendix, p. 34). There were no significant differences between the interaction of light and drycleaning on the fabric. Variance was highest for eighty hours and one drycleaning and lowest for one hundred sixty hours and one drycleaning.

Fabric II

Drycleaning (Table VIII, Appendix, p. 35). There were no significant differences between the number of drycleanings. Variance was highest before drycleaning and lowest for two drycleanings. The stitching yarn broke first, the filling yarns second, and the warp yarns last.

Exposure (Table IX, Appendix, p. 35). No significant differences occurred between the three exposures. Variance was highest for one hundred sixty hours of exposure and lowest for the unexposed specimens. The stitching yarn broke first and the filling yarns second. In the specimens tested before exposure, the warp yarns did not break completely apart and in some cases, they were pushed aside rather than broken. After eighty and one hundred sixty hours of exposure, the warp yarns broke in all samples.

Exposure x Drycleaning (Table X, Appendix p. 35). There were no significant differences between the interaction of light and drycleaning on the fabric. Variance was highest for one hundred sixty hours and one drycleaning and lowest for eighty hours and one drycleaning.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

This study was designed to evaluate some of the service qualities of two Malimo drapery fabrics. The specific factors studied were the effects of: (1) drycleaning on the dimensional stability, (2) drycleaning on the bursting strength, (3) light on the bursting strength, and (4) both light and drycleaning on the bursting strength. The two fabrics used for this study were of similar construction but of different fiber content.

Fabric I showed an excessive amount of shrinkage. Fabric II showed an even amount of shrinkage in the warp and filling yarns.

Each fabric was analyzed before and after eighty and one hundred sixty hours of exposure to light in the Weather-Ometer. The data from fabric I showed a significant loss at the five per cent level after eighty hours of exposure. Exposure did not have a significant effect on fabric II.

The fabrics were statistically analyzed before and after two coin-operated drycleanings in a perchloroethylene solvent for thirty minutes. There was a significant increase in bursting strength after one drycleaning for fabric I. Drycleaning did not have a significant effect on fabric II.

Each fabric was exposed and then drycleaned to determine the effect of both light and drycleaning on the bursting strength. There were no significant differences between the interaction of light and drycleaning for either fabric.

On the basis of the tests performed on the two Malimo drapery fabrics, the author believes that fabric II is more serviceable than fabric I as a drapery fabric. It should be noted however, that fabric I is of a different fiber content and is priced much lower than fabric II making it more feasible to replace fabric I after a shorter period of time.

Further investigation is needed to determine if similar results would be obtained if the fabrics were cleaned at a commercial drycleaning establishment. Both fabrics became limp after drycleaning with fabric I being affected more than fabric II.

Since fabric I showed a significant decrease in bursting strength after eighty hours of exposure, it is recommended that this fabric should be exposed for less than eighty hours to determine when the significant decrease in bursting strength did occur. The fabric should be exposed for more than one hundred sixty hours to determine the next significant decrease. Fabric II should be exposed for more than one hundred sixty hours to determine when the first significant decrease in bursting strength will occur.

More research is needed on both the Malimo fabrics and the suitability of the procedures used to test these fabrics. The procedures used for this study were primarily designed to test woven and knitted fabrics and may not be adequate to accurately evaluate the Malimo fabrics.

One of the problems mentioned by consumers using woven drapery fabrics of a similar open type construction has been the fabrics reaction to changes in humidity. It is recommended that research of this nature be done on the Malimo drapery fabrics. Colorfastness to light was not evaluated in this study but colorfastness should be evaluated.

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APPENDIX

TABLE II

MEAN BURSTING STRENGTH OF FABRICS I AND II

Fabric	Mean[1] (pounds)	Variance	LSD*
II	102.28	83.07	3.32
	*		
I	27.38	15.58	

TABLE III

MEAN BURSTING STRENGTH OF FABRICS I AND II
BEFORE AND AFTER DRYCLEANING

No. of Drycleanings	Mean[1] (pounds)	Variance	LSD*
1	70.78	1801.51	3.32
	ns		
2	68.04	1589.63	
	*		
0	64.66	1816.06	

(1 vs. 0: *)

TABLE IV

MEAN BURSTING STRENGTH OF FABRICS I AND II
BEFORE AND AFTER EXPOSURE

Hrs. of Exposure	Mean[1] (pounds)	Variance	LSD*
0	69.84	1719.06	3.32
80	67.92	1863.67	
160	65.71	1635.08	

[1]Ranked in descending order.

*Least significant difference at the five per cent level.

TABLE V

MEAN BURSTING STRENGTH OF FABRIC I BEFORE AND AFTER DRYCLEANING

No. of Drycleanings	Mean[1] (pounds)	Variance	LSD*
1	29.45	7.25	1.78
	ns		
2	* 29.22	12.46	
	*		
0	23.48	4.71	

TABLE VI

MEAN BURSTING STRENGTH OF FABRIC I BEFORE AND AFTER EXPOSURE

No. of Exposures	Mean[1] (pounds)	Variance	LSD*
0	29.44	18.59	1.78
	*		
160	* 26.85	9.12	
	ns		
80	25.84	13.86	

TABLE VII

MEAN BURSTING STRENGTH OF FABRIC I BEFORE AND AFTER EXPOSURE AND DRYCLEANING

Treatment	Mean[1] (pounds)	Variance	LSD*
160 hrs., 2 drycleanings	30.13	3.40	1.78
80 hrs., 1 drycleaning	28.24	5.29	
160 hrs., 1 drycleaning	27.98	1.44	
80 hrs., 2 drycleanings	26.49	2.38	

[1] Ranked in descending order.

* Least significant difference at the five per cent level.

TABLE VIII

MEAN BURSTING STRENGTH OF FABRIC II BEFORE AND AFTER DRYCLEANING

No. of Drycleanings	Mean[1] (pounds)	Variance	LSD*
1	112.11	63.92	6.53
2	106.87	49.57	
0	105.84	123.31	

TABLE IX

MEAN BURSTING STRENGTH OF FABRIC II BEFORE AND AFTER EXPOSURE

Hrs. of Exposure	Mean[1] (pounds)	Variance	LSD*
0	110.25	44.26	6.53
80	110.00	57.58	
160	104.57	137.15	

TABLE X

MEAN BURSTING STRENGTH OF FABRIC II BEFORE AND AFTER EXPOSURE AND DRYCLEANING

Treatment	Mean[1] (pounds)	Variance	LSD*
80 hrs., 1 drycleaning	116.17	10.88	6.53
80 hrs., 2 drycleanings	110.19	44.19	
160 hrs., 1 drycleaning	108.50	155.96	
160 hrs., 2 drycleanings	102.24	27.93	

[1]Ranked in descending order.

*Least significant difference at the five per cent level.

EFFECTS OF DRYCLEANING AND EXPOSURE TO LIGHT ON SELECTED SERVICE QUALITIES OF TWO MALIMO DRAPERY FABRICS

by

MARVA LOUISE MORRISON

B. S., Kansas State University, 1965

AN ABSTRACT OF A MASTER'S THESIS

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requirements for the degree

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Department of Clothing, Textiles, and Interior Design

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1969

This study was designed to evaluate some of the service qualities of two Malimo drapery fabrics composed of warp, filling and a stitching yarn, but of different fiber content. Fabric I was composed of 92 per cent cotton and 8 per cent polyester. Fabric II was composed of 67 per cent Verel modacrylic, 28 per cent viscose rayon and 5 per cent other fibers. The specific factors studied were the effects of: (1) drycleaning on the dimensional stability, (2) drycleaning on the bursting strength, (3) light on the bursting strength, and (4) the interaction of light and drycleaning on the bursting strength.

Specimens were exposed for eighty and one hundred sixty hours in the Weather-Ometer with the carbon arc as the source of light. Drycleaning was done in a coin-operated unit in a perchloroethylene solvent for thirty minutes.

Both fabrics shrank after each drycleaning. Fabric I shrank the most. At the five per cent level of probability, for fabric I there was a significant difference in bursting strength after one drycleaning and after eighty hours of exposure. There were no significant differences attributable to the interaction of light and drycleaning. Drycleaning, light, and the interaction of light and drycleaning did not have a significant effect ($P \leq 0.05$) on fabric II.