

COMPARISON OF A COTTON TEXTILE FABRIC WITH
GOVERNMENT MASTER SPECIFICATIONS

by

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INTRODUCTION

One of the problems confronting the modern housewife is the wise selection of yard goods. Although many people depend almost entirely upon ready-to-wear shops, families with low incomes still make much of their own clothing. At the present time when the market is flooded with excessive amounts of cheap merchandise and every newspaper advertises first grade materials at "startling reductions", the consumer should be able to judge quality and to know whether or not she is obtaining full value for the money expended. Unfortunately adulterations, over-dressing, and other methods are used to disguise the fabric and make accurate judgment difficult. Then too, the methods of manufacturing and finishing, the sources and treatment of the raw materials, and many other factors which cannot be determined by the appearance of the goods, play a very important part in fixing the durability of the final product.

Facing this situation, the trained buyer has difficulty in making wise choices. How much more unreliable must be the results obtained by the inexperienced purchaser! Brand names and the information secured from salespeople provide the only aids to personal judgment. Neither of these is very reliable. The familiar and dependable brands represent

a standard of some kind, but the changing conditions of production result in unheralded changes from time to time. Brand names are sometimes sold and the new owners alter the standard formerly maintained for the brand. Many brands carry no definite guarantee. The highly advertised brands may be of poorer quality than a similar product unadvertised. Then too, the same manufacturer may supply several grades of material under the company name and the unwary consumer may not realize that there is a difference in the quality (Chase and Schlink, 1928).

The information received from the saleswoman is often a less reliable guide than the brand name, for the clerk is employed to sell the fabric and makes any guarantee which she thinks will close the sale. Often the clerk does not have the necessary information and has no way of securing it. If the manufacturer makes no guarantee, the promises of the salesperson are not adequate protection for the customer.

Because of the standardization movement and increasing demand on the part of consumers, some large stores are beginning to test their products and to describe them more accurately. Certain household linens and blankets carry labels which state weight and size. Some manufacturers of sheeting guarantee a certain number of washings. The only description found on yard goods is a color guarantee of

more or less reliability. In 1929 Sears, Roebuck and Company, Montgomery Ward and Company, and a few others added thread count to the descriptions of certain fabrics in their catalogues. A few of the more progressive manufacturers have placed thread count and a color guarantee on the margin of the material. Aside from these meager bits of information, no definite knowledge of quality is made available to the customer. These few facts are not sufficient to insure to the consumer the durability of the cloth. Tensile strength, weight per square yard and the amount of finishing materials are fully as important as thread count in determining the life of the fabric.

Some effort has been made by the Bureau of Standards and various municipal and state purchasing departments to protect themselves from the unreliable practices of manufacturers and wholesalers. The Bureau and societies maintained by private organizations, such as the American Standards Association and the American Society for Testing Materials (Index to A.S.T.M. Standards, 1932), have set up standards and methods for testing various products. These methods are used by large institutions and government departments to determine the probable performance of goods before the purchase contracts are let. Standards have been developed for each article, and products which do not meet the required specifications are not accepted (Coles, 1932,

p. 252).

The individual consumer has no such protection. Although the specifications may be obtained, the expense of testing is prohibitive to the average purchaser. The retailer faces a similar difficulty. Realizing that there are some merchants who wish to secure the advantages of tested materials, the government offers what is called the Certification Plan. Under this arrangement those companies which are willing to supply for private trade materials that meet government specifications file a statement to that effect with the Bureau of Standards. The Bureau then publishes a list of these companies, which is available to interested groups. The government does not guarantee that the specifications will be met. It simply aids in bringing producers and possible consumers together without making any attempt to educate the consumer about the standards. Organizations which have directed the attention of the public to the standardization of fabrics used in the home have confined their efforts to household linens for which the style factor is of minimum importance.

Purpose

The Federal Specifications Board has set up standards for certain cotton textiles used for outer garments. It is the purpose of this study to determine the measurable qualities of market grades of percale, and from these data to

find whether they are equal to the standards set by the Federal Specifications Board. This fabric is a staple material which is not greatly affected by changing fashions. Then too, percale is a very common fabric for garments which receive considerable wear, i.e., aprons, dresses, pajamas and childrens' clothing. Many people during this period of financial stress turn to cheaper materials to supply their clothing needs. Hence this is an opportune time to investigate, in so far as it is possible with standard laboratory testing methods, the durability of percale and the relation of durability to cost. For these reasons it is a possible fabric with which to begin a standardization of garment materials similar to that now in progress for sheeting and some other household textiles.

REVIEW OF LITERATURE

The investigator was unable to find any material which has been published concerning the standards maintained for percales available to the average housewife.

With the exception of fastness to light, definite standards and accurate procedures have been established for measuring the physical characteristics listed by the Bureau of Standards. Considerable effort has been expended in trying to establish standards by which to measure the amount of fading. So far, measurements have depended upon personal

judgment. Differences in the sensitiveness of the eye and its training to make nice color distinctions lead to a variety of interpretations of experimental findings. Experiments are being conducted with the spectrophotometer and the colorimeter in an effort to minimize the human factor. So far, the use of both is very limited and technique and mechanism for easy and rapid manipulation have not been perfected (Freedman, 1932).

Another important problem in the measurement of fading is the source of light. Sunlight requires too long a time to be practical for commercial testing. No available artificial light source duplicates sunlight. The mercury quartz lamp, the incandescent light and the enclosed carbon arc were studied by the Sub-Committee of the American Association of Textile Chemists and Colorists under the direction of William Cady and William Appel (1927) at the Bureau of Standards. The great cost of maintenance and the difficulty of removing the excessive amount of infra-red from the incandescent light, and the faulty spectrum of the mercury quartz lamp have caused the committee to discredit them for testing purposes. The violet carbon arc seems to be the best available source of artificial light at the present time. Comparison of its spectrum (Cady and Appel, 1929) with that of the sun shows marked differences between 360 and 1400 millimu. This difference, no doubt, accounts for

the fact that yellows, oranges, greens, and some browns fade much more in the Fade-Ometer than in sunlight, and the blues and violets, in which the machine is very rich, fade less than in sunlight. The quality of the fading for many colors is different for artificial and natural light sources. The results produced by the carbon arc are similar on the same machine, but vary with different machines. Relative humidity is known to be an important factor in fading. The committee therefore recommended that the Fade-Ometer needed an improved spectrum and a method for controlling humidity.

According to the manufacturers of the Fade-Ometer (Jamison, 1932) artificial sources of light for testing color fastness are desirable because humidity, atmospheric conditions and geographical conditions vary and results are not reproducible. The weather in any one locality is not always the same, and therefore sun tests can seldom be duplicated. On the other hand, the Sub-Committee of the American Association of Textile Chemists and Colorists does not recommend any artificial light sources. It obtained approximately reproducible relative fading with sunlight in various parts of the United States. If quick test is desirable the committee recommended the carbon arc as most convenient and accurate of the artificial sources.

In 1931 the Sub-Committee published the findings relative to the classification of dyed fabrics subjected to the

standard Suntest A (Cady, Smith and Appel, 1931). Sun testing was chosen as the standard because results were duplicable, and the test conditions were most severe with reference to light exposure and least severe with reference to other agencies such as atmospheric humidity. Samples used by the committee were exposed on sunny days only from 10 A.M. to 3 P.M. in cabinets designed to permit free access of air. The specimen trays, protected by a good grade of 1/8 inch window glass placed 1/2 inch above the trays, were inclined toward the south at an angle of 45°. Changes of hue were considered more serious than changes of value or intensity in classifying the specimens, since alteration of the first type might disrupt a color scheme.

The classes designated by Cady, Smith and Appel (1931), together with the estimated equivalent of all-weather exposure in a standard sun cabinet facing south, are as follows:

<u>Class</u>	<u>Standard Sun Test Requirement</u>	<u>All-weather Exposure</u>
0	Appreciable change in 6 hours, marked change in 12 hours	Less than 2 days
1	Little or no change in 6 hours, appreciable change in 12 hours	2 days
2	Little or no change in 12 hours, appreciable change in 24 hours	5 days
3	Little or no change in 24 hours, appreciable change in 48 hours	9 days
4	Little or no change in 48 hours, appreciable change in 96 hours	19 days
5	Little or no change in 96 hours, appreciable change in 192 hours	37 days
6	Little or no change in 192 hours	75 days

Some studies are being conducted to determine how much color loss is acceptable to the customer, but to date none of the findings have been released (Freedman, 1932). From time to time tests have been made to determine the reliability of brands and manufacturers' guarantees. One of the most recent of these investigations was conducted at the University of Missouri by Miss Jessie V. Coles and Margaret Kirkpatrick (1928) with 103 cotton fabrics. Fastness to laundering and to light were determined. A quartz mercury lamp was used as the source of light. The results indicated that as a rule guaranteed fabrics were decidedly more reliable than non-guaranteed, and materials sold under brand names were slightly more dependable than non-branded fabrics in fastness both to light and to laundering, but in some cases results varied widely. The range in price was higher for the guaranteed than for the non-guaranteed, but greater reliability and better quality offset this increased cost in some cases.

DEFINITION OF FABRIC TESTED

"Percale"¹, according to the Standard Textile Dictionary, "is a plain woven, light weight, smooth finish, closely

¹ Extract from a letter from P. G. Agnew, Sec. of Am. Standards Association, to the writer (July 23, 1931).

woven, cotton printed fabric used for dresses, etc. The finished cloth construction is usually 36 inches wide. Count of fabric 80 x 80. Weight four yards per pound."

The United States Government Master Specification for Percale (1928), however, requires a thread count of 85 x 72 with a tolerance of minus three or any plus threads. Other requirements set were: width, 36 inches plus or minus 1/4 inch; weight per square yard, 3.1 ounces with a tolerance of minus 2-1/2 per cent and plus 5 per cent; breaking strength (minimum), warp 45 pounds and filling 30 pounds per inch; fastness of dye to light and laundering, "good".

SELECTION OF MATERIAL

The names of manufacturers of percales that meet government standards were obtained from "Sources of Supply of Commodities Covered by U. S. Government Specifications" (1931). Names of retail companies to which the percales were sold were secured from these producers. Samples were obtained from the two retailers in this trade area who carried such fabrics. One store was located at Fort Worth, Texas, the other at Kansas City, Missouri. Six specimens purchased at twenty-five cents per yard were guaranteed to equal the requirements of United States Government Master Specification for Percale (1928). For experimental purposes

PLATE I

EXPLANATION OF PLATE I

1. Specimen 9, guaranteed to meet government specifications. Price, 25 cents.
2. Specimen 9 after 30 days all-weather exposure.
3. Specimen 10. Guaranteed color fast. Price, 17 cents.
4. Specimen 10 after 30 days all-weather exposure.
5. Specimen 1. Guaranteed to meet government specifications. Price, 25 cents.
6. Specimen I after 30 days all-weather exposure.
7. Specimen 2. Guaranteed color fast, thread count, 80 x 80. Price, 17 cents.
8. Specimen 2 after 30 days all-weather exposure.

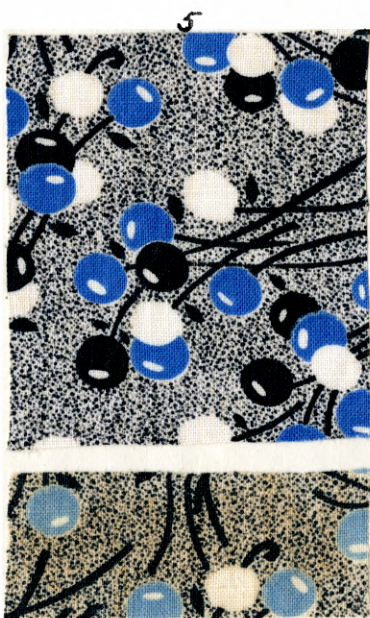


PLATE II

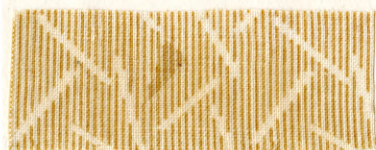
EXPLANATION OF PLATE II

9. Specimen 3. Guaranteed to meet government specifications. Price, 25 cents.
10. Specimen 3 after 30 days all-weather exposure.
11. Specimen 4. Guaranteed color fast, thread count, 80 x 80. Price, 17 cents.
12. Specimen 4 after 30 days all-weather exposure.
13. Specimen 11. Guaranteed to meet government specifications. Price, 25 cents.
14. Specimen 11 after 30 days all-weather exposure.
15. Specimen 12. Guaranteed color fast, thread count, 80 x 80. Price, 17 cents.
16. Specimen 12 after 30 days all-weather exposure.

9



10



11



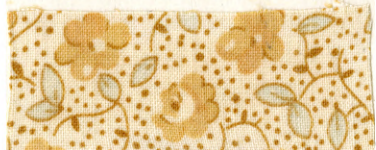
12



13



14



15



16



PLATE III

EXPLANATION OF PLATE III

17. Specimen 7. Guaranteed to meet government specifications. Price 25 cents.
18. Specimen 7 after 30 days all-weather exposure.
19. Specimen 8. Guaranteed color fast, thread count, 80 x 80. Price, 17 cents.
20. Specimen 8 after 30 days all-weather exposure.
21. Specimen 5. Guaranteed to meet government specifications. Price, 25 cents.
22. Specimen 5 after 30 days all-weather exposure.
23. Specimen 6. Guaranteed color fast, thread count, 80 x 80. Price, 17 cents.
24. Specimen 6 after 30 days all-weather exposure.

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23



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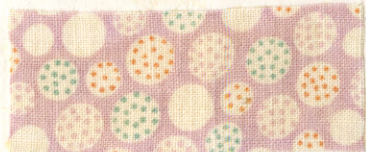


PLATE IV

EXPLANATION OF PLATE IV

- 25. Specimen 13. Guaranteed to meet the standard of a chain store; no sizing. Price, 17 cents.
- 26. Specimen 13 after 30 days all-weather exposure.

25



26

these fabrics were designated as specimens 1, 3, 5, 7, 9 and 11.

The color and type of design of each of the specimens first chosen were duplicated as nearly as possible at local stores. The salespersons were questioned regarding thread count, color fastness, percentage of sizing, and the amount of shrinkage to be expected. The clerks in every case stated that the fabric was supposed to be fast in color. Four of the five saleswomen consulted gave no information concerning the amount of finish contained in the material. The clerk in the chain store at which specimen 13 was obtained stated that none of the percales in that store were sized. She also volunteered the information that the materials would shrink some in length but none in width. This was a general opinion among clerks and consumers alike in the three communities in which the specimens were purchased. Most of the salespeople stated that the fabric was not supposed to shrink, but that it usually shrank a little. Only one sales girl was informed on the subject. She said that the amount of shrinkage varied considerably and that no accurate estimate of the shrinkage of a given fabric could be made, but a minimum allowance should be one inch per yard. Specimens 4 and 12, designated as Brand A, and specimens 2, 6 and 8, called Brand B, were supposed to have a thread count of 80 x 80. Specimen 10 was also in Brand

B, but the clerk was not informed concerning the thread count. Specimen 13, the only swatch purchased at a chain store, was guaranteed to meet "our standard". All of these fabrics were bought for seventeen cents per yard, but a week later the standard price of specimens 8, 10 and 12 was reduced to fifteen cents.

APPARATUS AND PROCEDURE

The thirteen selected fabrics were tested by the method outlined in "The General Specification for Textile Materials" (1929). Where optional methods are given for making tests, the procedure specified as the umpire method was used because it is usually more rapid, and therefore, the one to which the fabric would be subjected in case of dispute.

The width of the fabric was measured with a standard yard stick. The number of threads per inch was determined by means of a Lowinson micrometer placed over an illuminated box.

Breaking strength and weight per square yard were determined under standard conditions of temperature and humidity. A Carrier Unit Air Conditioner was used to maintain a constant relative humidity of 64-65 per cent. The temperature range was 70-71° F. Tensile strength was determined on a Combination Scott Tester installed in the room. Weight

per square yard was determined as follows: the specimens, together with weighing bottles, were placed in a desiccator from which the calcium chloride had been removed and were maintained at standard conditions for four or more hours; the samples were transferred to the weighing bottles and allowed to remain in the room for one half hour longer; then the bottles and the desiccator were closed and the weighings made in another room. A Chainomatic balance which was accurate to one-tenth of a milligram, was used for all weighings.

Because the temperature of the conditioning room cannot be controlled in summer, the amount of sizing was determined by obtaining the absolute dry weight, and then adding the standard regain (6.75 per cent for this type of cotton material) before calculating the percentage of finish (Haven, 1932). The material, cut on the diagonal of the fabric in order to reduce to the minimum the losses from ravelling, and the weighing bottles were dried for two or more hours (to constant weight) in an Emerson Conditioning Oven at 110° F. The specimens were transferred to the weighing bottles, dried for one half hour longer, cooled in a desiccator, and weighed. The finish was removed and the drying and weighing were repeated. The standard cotton regain was added to the weight of each sample. Then the percentage of finish was determined from the difference in

the calculated weights by using the mass of the sized fabric as the base. Although the results may not be absolutely accurate, they are probably more nearly so than would be possible if the relative humidity had been kept at standard and the temperature had varied markedly.

Color fastness was determined by means of the Launder-Ometer and the Fade-Ometer manufactured by the Atlas Electrical Device Company. The temperature and relative humidity were measured by means of two calibrated thermometers hung in the case as near the specimens as possible. The wet-bulb thermometer was contained in a small metal bucket attached to the thermometer well above the bulb. A wick, which covered the bulb completely, extended into the bucket. The water in the small reservoir was replenished every hour. The differences in the readings of the wet and dry-bulb thermometers were used as a basis for obtaining relative humidity from a table. The relative humidity did not at any time exceed 10 per cent. The temperature of the Fade-Ometer was maintained at 95-99° F. by placing an electric fan below the level of the globe. The machine was operated on a 220 volt circuit.

A study of Fade-Ometer tests made by the manufacturer showed that yellows, oranges, greens and browns fade more than in sunlight because there are fewer of these light rays in the carbon arc spectrum than in that of natural

light. The Fade-Ometer spectrum, on the other hand, is rich in blues and visible violets, and these hues fade less than in sunlight. Since the most of the specimens contained one or more of these colors, a parallel all-weather test was run. The test was conducted during the month of August in a standard sun cabinet with a south exposure. During the thirty days of the test, the temperature ranged from 66.29° to 93.22° F. with an average of 79.75° F. The total precipitation for this period was 4.11 inches. The second night of the test 1.10 inches fell and during the twenty-ninth day .92 inches were recorded by the official weather station. The remainder of the moisture fell in 1/4 to 1/2 inch showers during the latter part of the month. Twelve days were clear; five, cloudy; seven, partly cloudy; six were cloudy about half the day and clear the rest of the day.

The procedures and equipment described in "General Specification for Textile Materials" (1929) with the adaptations discussed above were used. One sample each was used for studying color fastness and shrinkage; two were used for determining finish; all other recorded data are the averages of five specimens tested under identical conditions.

TABLE I. FABRIC ANALYSES OF THIRTEEN SPECIMENS OF PERCALE.

Number F.S.B.S.+	Price	Width	Weight per	Finish	Threads per Inch		Breaking Strength		Shrinkage in Inches		Fastness		Fastness to Light
		in	Square Yard	in Per	Warp	Filling	in Pounds per Inch	per Yard	per Yard	per Yard	to	to	
		Inches	in Ounces	Cent			Warp	Filling	Warp	Filling	Laundrying	All-weather	Fade-Ometer
556	--	36*	3.1*	3 max.	85*	72*	45 min.	30 min.	---	---	good	good	good
1.	.25	36	3.375	2.53	85	73	42.8	40.2	.9	1.575	good	poor	good
2.	.17	36 1/16	3.220	2.63	85	73	35.9	23.0	.9	.675	good	poor	good
3.	.25	36 5/16	3.397	3.14	85	75	38.8	30.9	1.575	1.125	fair	poor	good
4.	.17	36 1/8	3.276	1.21	84	72	43.0	37.0	.9	.675	good	poor	fair
5.	.25	36	3.253	2.65	86	74	42.1	27.0	1.460	.675	good	poor	fair
6.	.17	36	3.316	1.60	86	74	43.3	29.1	1.125	.9	good	poor	good
7.	.25	36	3.388	2.17	85	75	41.0	33.7	.675	.675	good	poor	good
8.	.17	36	3.228	1.47	86	73	46.0	28.4	1.125	.9	good	poor	good
9.	.25	36	3.333	2.96	86	74	39.1	27.5	1.350	.9	good	poor	good
10.	.17	36 1/16	3.298	3.45	85	72	44.2	28.1	1.350	.45	good	poor	poor
11.	.25	35 3/4	3.350	2.89	87	75	43.4	28.1	1.01	.9	fair	poor	fair
12.	.17	36 1/4	3.230	1.60	83	72	46.4	37.7	1.125	.675	good	poor	good
13.	.17	36 1/8	3.369	4.74	85	75	43.2	16.1	1.125	.675	good	poor	good

+ Federal Specifications Board Specification No. 556

* Tolerances

Width -- plus or minus 1/4 inch

Weight per square yard -- minus 2 1/2 per cent and
plus 5 per cent

Thread count -- minus 3 threads and any plus

INTERPRETATION OF DATA

The thread count and the width of all fabrics were within the limits set by the government specification.

The amount of finish varied from 1.21 to 4.74 per cent. Specimen 10 contained a slight excess and specimen 13 contained a large excess of finishing materials. None of the other fabrics exceeded the maximum percentage for sizing.

Weight per square yard ranged from 3.22 to 3.397 ounces. Nine of the samples, five of them supposed to meet the requirements of the Master specification, exceeded the maximum weight per square yard. This added weight would not be a fault for certain purposes, unless the increase in weight were due to over-sizing. A decrease of 2 per cent in the amount of finish would bring most of these fabrics below the maximum and probably would not affect the "handle" of the fabric appreciably.

None of the fabrics, except specimen 12, reached the minimum breaking strength for both warp and filling. On the whole the materials not guaranteed to meet government specification showed higher breaking strength than those so guaranteed. It is interesting to note that in the grades of fabric studied there is no close relation between breaking strength, and threads per inch and weight per square

yard--information concerning which is sometimes available to the consumer. The consumer has no means of obtaining breaking strength, although it is a surer guide to the durability of the fabric than either thread count or weight per square yard. The number of threads in the warp of the fabrics tested fell between 83 and 87, a difference of only four, yet tensile strength varied by 10.5 pounds (35.9-46.4 pounds). Breaking strength of the filling showed even greater deviations. The number of threads ranged from 72 to 75 per inch, yet the breaking strength varied from 40.2 to 16.1 pounds. The strongest warp contained the least number of threads per inch; and the weakest filling contained the most filling threads per inch. Breaking strengths of specimens 1 to 12 were uniform, but those of specimen 13 showed striking deviations. The five specimens for this test were taken from the fabric in such a way that the strain would be applied every six inches along the length of the cloth. Alternate samples were ruptured by a force of about 6.3 pounds. The others broke under a stress of about 25.5 pounds. A repetition of the test with the same and with different sets of threads produced the same results. At first this difference was attributed to the chemicals used in stripping the dye to produce variation in the value for the figure used in the background, but comparison of the design in the ruptured specimens failed

to reveal any relationship. A retest of the warp threads selected to reveal any similar weakness along the length corresponded with the original data. Evidently some mistreatment of the thread or fiber before weaving accounts for the wide difference in the strength of the filling yarns.

The shrinkage of the warp of the percales varied from .9 to 1.575 inches per yard; the filling threads from .45 to 1.575 inches. In two cases the warp shrank less than the filling, but in most of the materials the reverse was true. In specimen 7 the warp and the filling shrank the same amount. The variations were more marked in the filling than in the warp. Although the number of fabrics tested was small, it seems safe to say that shrinkage allowances should be made for both warp and filling, and that there is no average sufficiently accurate to be a reliable guide in determining the amount of shrinkage to be expected.

Color fastness of most of these fabrics was satisfactory for laundering purposes. The heavy black figures in specimens 1 and 2 colored the white material a red violet during the drying. The materials, however, did not appear to be faded. Specimen 10 crocked slightly during the laundering test. The darker tan in specimen 3 became redder. A similar change occurred when it was treated

with pure cold water. No doubt this alteration is due to a loss of finish.

The Fade-Ometer exposures showed two-thirds of the swatches to be of "good" color fastness to light. Specimens 4, 5 and 11 were of "fair" fastness and specimen 10 was "poor". The results of the suntest were much less satisfactory. A thirty-day all-weather exposure caused marked loss of color in all fabrics. The pinks and greens were nearly white and the browns were changed to muddy unattractive hues. All other fabrics showed considerable change in color. When the fadings were classified according to the seven standards promulgated by the Sub-Committee of American Association of Textile Chemists and Colorists, eight of the specimens, 3-10 inclusive, were in class II; four specimens, 2, 12 and 13, were in class III. About 62 per cent of the dyes showed appreciable change at the end of five days' exposure. In every case a marked change in color occurred within nineteen days. The temperature during this exposure averaged about fifteen degrees lower than that of the carbon arc, and at no time did it exceed the maximum temperature of the Fade-Ometer. Although no satisfactory average could be obtained, the relative humidity for the all-weather test was much higher than the 10 per cent maximum of the artificial conditions. Under both natural and artificial fading conditions the browns

and tans showed a tendency to change in hue as well as in intensity. Some of the yellows and oranges darkened to unattractive shades. Other colors changed only in value and intensity.

Specimen 12 fulfilled the requirements of the specifications in all tests except the all-weather exposure. Since it passed the umpire test of the carbon arc, it would no doubt be ranked as government standard by commercial test. The other fabrics were fairly satisfactory under artificial fading conditions, but the lower breaking strength would probably impair their wearing qualities.

SUMMARY

The number of swatches tested was insufficient to warrant an unqualified statement of conclusions, but the results tend to show the following facts concerning market percales.

1. Width and number of threads per inch in every case were well within the limits set by the government standard.
2. The amount of finish varied considerably, but in 85 per cent of the fabrics the percentages ranged well under the maximum fixed by the government specifications.
3. None of the above qualities showed any close relation to the breaking strength of the fabric. The breaking strength of the fabric is one of the more important

criteria to its durability. For this reason such information should be given the consumer.

4. Fastness to laundering was "good" in eleven of the thirteen materials tested. The two which graded "fair" were supposed to meet the government standard. The fastness to laundering seems, according to this test, to be an already established standard in these qualities of percale.

5. Results obtained with the Fade-Ometer are not a reliable guide to the light fastness of fabrics subjected to the summer suns of Kansas, for all fabrics proved to have unstable colors in an all-weather exposure, although only one was so rated after exposure to the carbon arc.

6. The shrinkage is usually greater in the warp than in the filling, but results are not sufficiently uniform to be a reliable guide in making shrinkage allowances for construction problems.

7. There was no appreciable difference between the materials guaranteed to reach government specifications and those which were not so guaranteed. The only specimen which attained the standard was not guaranteed to do so.

8. There is no visible difference in the quality of these fabrics which might guide the consumer to select the better material.

9. More definite and reliable information regarding the essential characteristics of the fabrics for sale should

be provided for the salespeople.

10. The difference in price can be warranted only upon the basis of style or more charming color harmony, since other qualities of the fabric are not superior in the more expensive materials. It is doubtful if an increase of 47 per cent in the price of the cloth would be legitimate for style alone.

11. The market percales of the grades studied seem to be fairly well standardized as to thread count, width and percentage of finish, but show considerable variation in weight per square yard and breaking strength.

ACKNOWLEDGMENT

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