United States Patent

Shippee et al.

[15] **3,660,011**

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[54] DIMETHYL SULFOXIDE USED AS A SOLVENT FOR TEXTILE TREATING COMPOSITIONS

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[21] Appl. No.: **635,924**

Related U.S. Application Data

[63] Continuation of Ser. No. 332,799, Dec. 23, 1963, abandoned.

[52] **U.S. Cl.** **8/116.3,** 8/129, 8/116.2, 8/115.6, 8/115.7, 8/115.5, 8/127.6, 260/29.4

[51] **Int. Cl.** **D06m 13/40,** C08g 51/46

[58] **Field of Search** 8/116.2, 116.3; 260/29.4

[56] **References Cited**

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[57] **ABSTRACT**

The crease resistant properties of cellulosic fabrics is improved by rendering the fabrics highly resistant to both wet and dry wrinkling without serious detriment to fabric tensile strength, tear strength and flex abrasion resistance. This is accomplished by including dimethyl sulfoxide as an essential ingredient in the aqueous solution used to treat a cellulosic fabric with a nitrogen-containing water-soluble organic crease-proofing material.

8 Claims, 4 Drawing Figures

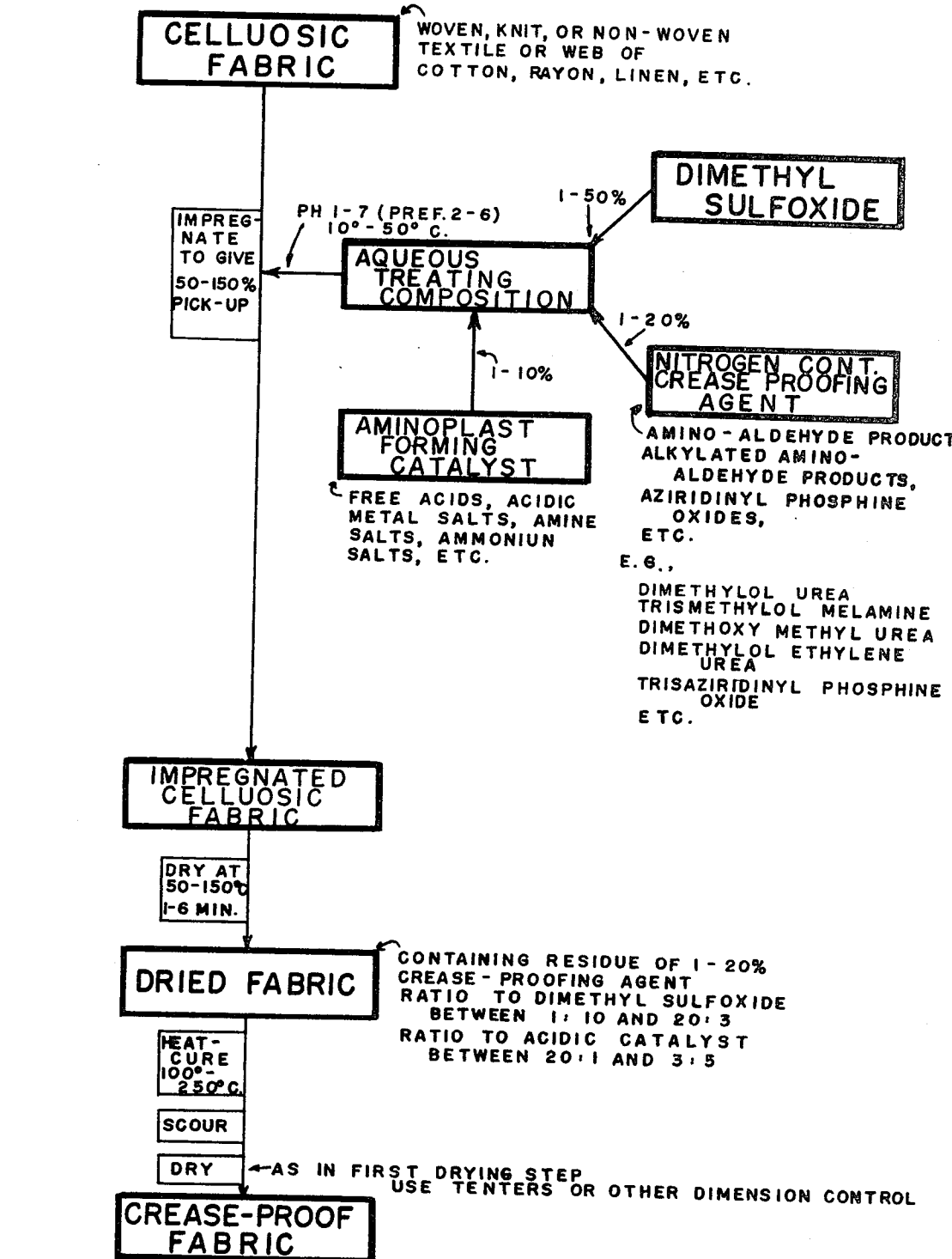


FIG. 1

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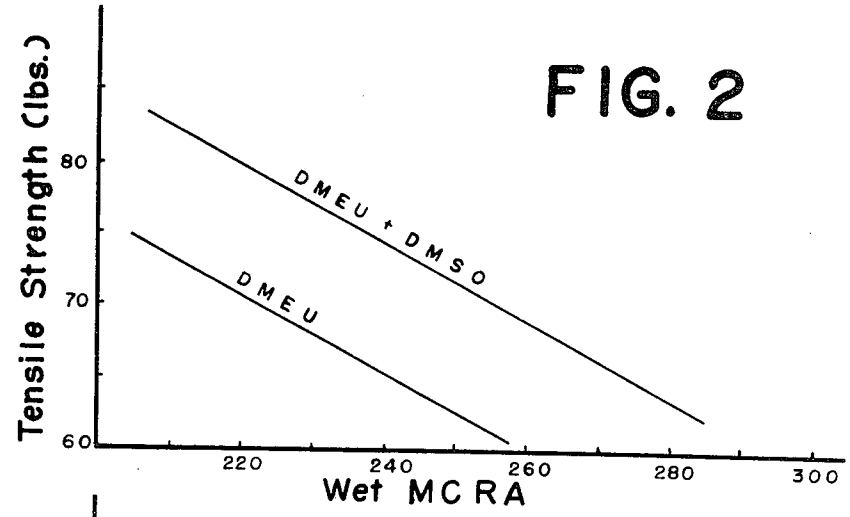


FIG. 2

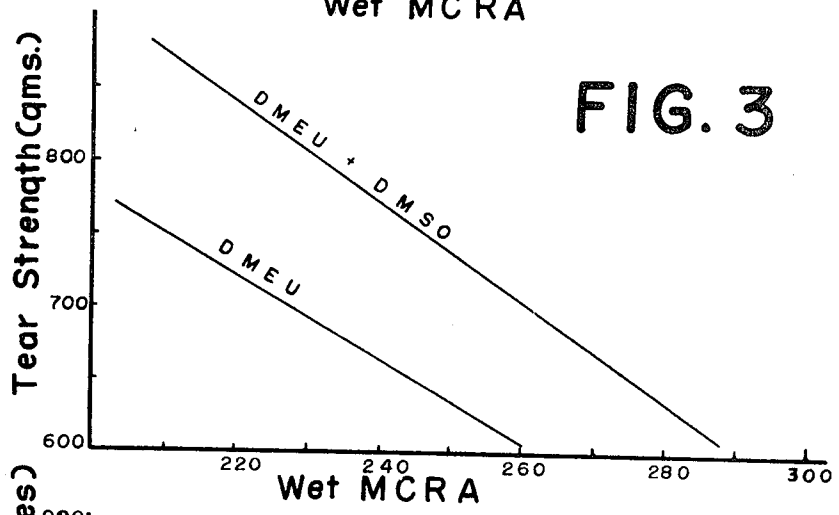


FIG. 3

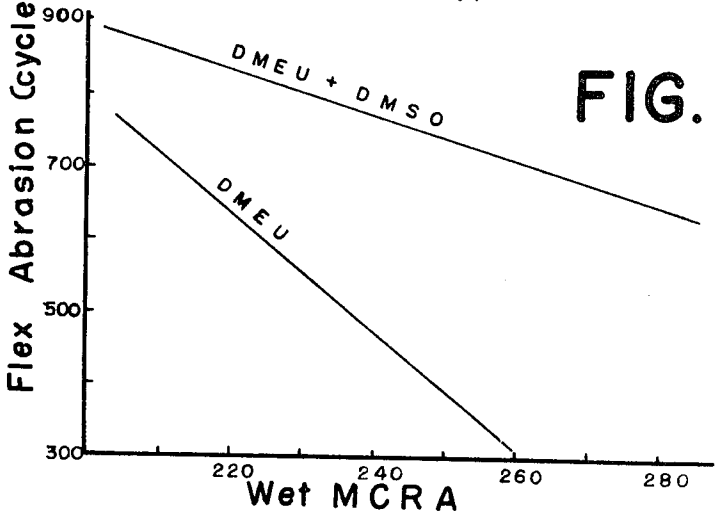


FIG. 4

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DIMETHYL SULFOXIDE USED AS A SOLVENT FOR TEXTILE TREATING COMPOSITIONS

CROSS-REFERENCE TO RELATED APPLICATION

Reference is made in accordance with 35USC 120 to copending application Ser. No. 332,799, filed Dec. 23, 1963, now abandoned of which the present is a continuation.

FIELD OF THE INVENTION

The art of treating cellulosic fabrics with chemical reagents to improve crease resistance is highly developed. Actually, such procedures are widely practiced today on a commercial scale so that cotton fabrics that have been treated with cross-linking agents to improve wrinkle resisting properties are readily available to any interested buyer. Fabrics of this type are widely used in the making of wear apparel, for example, men's shirts and women's dresses. The popular term for this type of material is "wash and wear" fabric.

Procedures for finishing cellulosic fabrics with chemical agents to improve crease resistance can be divided into two broad, separate categories, namely, those which utilize aqueous solutions of treating agents and, contrastingly, those which must be used under anhydrous conditions, usually employed inert or non-reactive organic solvents.

The present invention relates to the category of fabric treatments which fall in the first class, namely, those which use aqueous solutions. In this category of treatments, there exist procedures which impart wet crease resistance without modifying to any appreciable extent the dry crease resistance of the fabric. Also, there are procedures which improve dry crease resistance without appreciable affect upon wet crease resistance. There is yet a third class of procedure which effects an improvement in both the wet and dry crease resistant properties of the fabric which is treated. The present invention concerns this third category of operation.

Anti-creasing agents applied to cellulosic fabrics from aqueous solutions function basically in one or two ways. The agent may be in itself capable of thermosetting into a resinous material and the resulting crease resistance of the treated fabric may be due entirely to internal cross-linking of the treating agent while mechanically bonding to the fibers. Theoretically, since reaction between the treating agent and the fibers is unnecessary for the anti-creasing effect, such agents could be used for the processing of fabric material made of any type fiber. At the other end of the spectrum of water-soluble, anti-creasing agents, are materials which in and of themselves are not capable of thermosetting or forming resinous reaction products but which depend, for their anti-creasing properties, entirely upon reaction with cellulose fibers of the treated fabric. Obviously, such agents would be restricted in their use to the treatment of fabrics containing cellulosic fibers or fibers of other substances which would be capable of reacting with the treating agent to effect a cross-linking or some other type of chemical reaction which would produce the crease resistance in the treated fabric.

Many treating agents which have been suggested and some of which are commercially used today in the processing of cotton fabrics into wash and wear materials do not fit strictly into either of these two ends of the spectrum. Thus, the ultimate crease resistant properties of the treated fabrics appear to be due to not only reaction between the treating agent and the cellulose, but also cross-linking between the treating agent itself resulting in a substantial amount of thermoset resin formation in conjunction with reaction with hydroxyl groups of the cellulose fibers. The present invention concerns improvements in the finishing of cellulosic fabrics within the total spectrum of anti-creasing agents that fall in the group of those which are nitrogen-containing, water-soluble and, at least to some extent, cellulose-reactive. This encompasses the majority of nitrogen-containing fabric treating agents used on a commercial scale at the present time for imparting crease resistance to cellulosic fabrics.

By the term "water-soluble" as used herein, is meant a material which can be dissolved to an extent of at least 1 percent by weight in water at 20° C.

The treatment of cotton and other cellulosic fabrics with anti-creasing agents is well described in patents and technical literature. Early in the development of the art, reaction products of urea with formaldehyde were employed and later used with modifications (see U.S. Pat. No. 2,808,341). Water-soluble reaction products of formaldehyde with melamine later were developed as offering certain advantages (U.S. Pat. No. 2,819,179). These materials had the disadvantage, however, of rendering the treated fabric susceptible to degradation upon bleaching with chlorine containing bleaching agents followed by heating.

This led to the development of the use of formaldehyde condensation products of cyclic ureas which had improved characteristics as regards chlorine degradation. For example, ethylene urea-formaldehyde reaction products (U.S. Pat. No. 2,898,238), propylene urea-formaldehyde products (U.S. Pat. No. 2,899,263), bis-hydroxyethylene urea-formaldehyde reaction products (U.S. Pat. No. 3,029,164) and related amino-aldehyde condensation products. Other nitrogen-containing, water-soluble, condensation products of aldehydes with amino compounds have been used for the treatment of fabrics in order to create anti-creasing or wrinkle resistance in the fabrics, such as tetrahydro-s-triazones (U.S. Pat. No. 2,950,552), aminotriazines (see U.S. Pat. No. 2,191,362) and the like. Most of these materials impart dry crease resistance to cotton fabrics with an accompanying strength loss of 25 to 35 percent and this has been one of the major problems in the use of this type of finishing agent for obtaining crease resistance in cellulosic fabrics. Of even more concern, is the fact that strength loss of 50 percent or greater usually results when these agents are used with cotton at a sufficiently high level to impart good wet-crease recovery to the fabrics.

High degrees of wet-crease recovery can be achieved with other classes of cellulose cross-linking agents and some of these are capable of imparting, under the properly applied conditions, dry-crease recovery as well as wet-crease recovery. For example cyanoethylation under controlled conditions may be used for this purpose. Also, formaldehyde in relatively high concentrations applied under acid conditions has been used for cross-linking cellulose to achieve wrinkle resistance, while materials applied under alkaline conditions for this purpose include divinyl sulfone or its derivatives (U.S. Pat. No. 2,524,399), or epichlorohydrin or its derivative (U.S. Pat. No. 2,985,501). The treatment of cellulose with these latter types of anti-crease agents inherently result in relatively high tensile strength losses in the fabric, degradation of color, and generally the dry-crease resistance characteristics of the fabrics are not good.

It is also possible to treat cellulose or cellulose-containing fabrics with other cross-linking agents which will produce various effects in the fabric without, however, appreciably effecting the crease resistant qualities of the fabric. For example, cellulose fabrics may be treated with diisocyanates to make them water-repellent and improve wet and dry strength (see U.S. Pat. No. 2,339,913). Such treatments must be carried out under non-aqueous conditions and various anhydrous solvent systems have been suggested for this purpose, for example, dimethyl sulfoxide (see U.S. Pat. No. 3,007,763).

Although, as is apparent from the above discussion, the treatment of cellulosic fabrics, and cotton textiles in particular, to improve anti-creasing or wrinkle resisting properties is a highly developed art, there is still much room for improvement. There is a need for methods which can be utilized in a commercially feasible manner to treat cotton textiles or other cellulosic fabrics to impart to the fabrics high level of both wet and dry wrinkle resistance without, at the same time, creating loss in tensile strength and without adversely effecting other desirable properties of the treated fabric.

OBJECTS

A principal object of this invention is the provision of new processes for improving the wet and dry wrinkle resistance of cotton and other cellulosic fabrics without at the same time creating unacceptable losses in strength and other desirable characteristics of the fabric.

Further objects include:

1. The provision of new and improved cellulose reacting compositions that are effective in rendering cotton, linen, viscose rayon, acetate rayon and like textile fabrics highly wrinkle resistant in a wet state and at the same time produce dry wrinkle resistance while retaining good strength properties.

2. The provision of new compositions which comprise water-soluble compounds which can be readily applied to fibrous materials with conventional treating techniques to impart the wet and dry crease resistance to the textile fabrics without high strength losses.

3. The provision of improvements in the use of water-soluble cellulose cross-linking agents to impart to cellulose fabrics wet and dry crease resistance which mitigate loss in tensile strength, tear strength and flex abrasion of the treated fabric.

4. The provision of cellulose cross-linking processes that improve uniformity of fiber reaction throughout the substrate rendering the substrate highly resistant to wet and dry creasing while maintaining high tensile, tear strength and abrasion resistance.

5. The provision of improved cellulose fabrics having good wash and wear qualities and relatively high strength.

6. The provision of new compositions and methods for producing wash and wear cloth for men's shirting, dress goods, children's apparel, bedding and outer wear.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

GENERAL DESCRIPTION

These objects are accomplished according to the present invention by the treatment of cellulosic fabrics with aqueous solutions of nitrogen-containing, water-soluble, heat-curable organic crease-proofing materials which include as an essential ingredient, dimethyl sulfoxide.

More particularly, the invention encompasses imparting crease resistance to cellulosic fabrics by:

A. impregnating a cellulosic fabric with an aqueous solution which contains:

a. a water-soluble, nitrogen-containing, heat-curable organic crease-proofing material selected from the group consisting of:
   water-soluble amine-aldehyde reaction products
   water-soluble alkylated amine-aldehyde reaction products
   aziridinyl phosphine oxides, and
b. dimethyl sulfoxide,

B. drying the impregnated fabric to leave a residue in the fabric of the water-soluble crease-proofing material and dimethyl sulfoxide,

C. heating the dried fabric to an elevated temperature sufficient to heat cure the impregnated material and create crease-resistance in the fabric. Advantageously, the treatment is carried out under acid conditions, i.e., a pH between about 1–7 and preferably a pH between about 2–6, in the presence of an acidic aminoplast forming catalyst.

Advantageously, the new treating compositions are water solutions containing between about 1 to 20 percent by weight of the nitrogen-containing, crease-proofing agent, 1 to 50 percent by weight of the dimethyl sulfoxide and 1 to 10 percent by weight of an acidic aminoplast forming catalyst. Such solutions are applied to the fabric by padding or comparable impregnating methods to give a pickup of about 50 to 150 percent by weight of such aqueous solutions.

Following the application of the aqueous treating solution, the impregnated or otherwise treated fabric or fiber substrate is dried and then heated to a temperature to effect curing of the impregnated fabric. Typical drying conditions involve heating to a temperature of 100° to 150° C. for between 1 and 60 minutes and typical curing conditions involve heating to 100° to 200° C. for 1 to 60 minutes following drying. After the curing operation, the treated fabrics are preferably scoured to remove unreactive materials and dried, advantageously with dimension control to fix the final shape and dimensions of the treated and dried fabric.

DRAWINGS

A further understanding of this invention may be had by reference to the accompanying drawings in which:

FIG. 1 is a flow diagram of the treatment of cellulosic fabrics to impart crease resistance, both wet and dry, to the fabric, the flow diagram being of the style suggested by M. O. Wolk, 30 J.P.O.S. 368. Space limitations prevent the flow sheet from illustrating all the process details which should be obtained from the following disclosure.

FIG. 2 is a graph illustrating the improvement obtainable in the ratio of tensile strength to wet-crease resistance in accordance with the present invention in comparison with such ratio obtainable with a comparable operation in accordance with the prior art.

FIG. 3 is a graph similar to FIG. 2 illustrating the improvement in the ratio of tear strength to wet-crease resistance obtainable by the improvements of this invention.

FIG. 4 is a graph similar to FIGS. 2 and 3 in which improvement in the ratio of flex abrasion to wet crease resistance is illustrated.

EXAMPLES

A more complete understanding of the new methods, compositions and improved cellulosic fabrics of this invention may be had by reference to the following detailed examples of operations conducted in accordance with the invention. In these examples and throughout the remainder of the specification and claims, all parts and percentages are by weight unless otherwise specified.

EXAMPLE 1

Samples of plain weave cotton print cloth were impregnated by total immersion in the test solution at 20° C. followed by mangling to give about 80 percent wet pickup, then framed to the original dimensions, dried in a hot air oven for 5 minutes at 120° C. and cured in a second hot air oven for 5 minutes at 150° C. The fabric samples were washed in an automatic home washer to remove unreacted materials and redried on frames for 5 minutes at 120° C. The different test solutions used were:

Solution 1
2 percent dimethylol ethylene urea
1 percent hydrated zinc nitrate
Solution 1A
2 percent dimethylol ethylene urea
1 percent hydrated zinc nitrate
10 percent dimethyl sulfoxide
Solution 2
4 percent dimethylol ethylene urea
1 percent hydrated zinc nitrate
Solution 2A
4 percent dimethylol ethylene urea
1 percent hydrated zinc nitrate
10 dimethyl sulfoxide
Solution 3
6 percent dimethylol ethylene urea

1 percent hydrated zinc nitrate
Solution 3A
6 percent dimethylol ethylene urea
1 percent hydrated zinc nitrate
10 percent dimethyl sulfoxide
Solution 4
8 percent dimethylol ethylene urea
1 percent hydrated zinc nitrate
Solution 4A
8 percent dimethylol ethylene urea
1 hydrated zinc nitrate
10 percent dimethyl sulfoxide
Solution 5
10 percent dimethylol ethylene urea
1 percent hydrated zinc nitrate
Solution 5A
10 percent dimethylol ethylene urea
1 percent hydrated zinc nitrate
10 percent dimethyl sulfoxide

The fabric samples were conditioned for 24 hours at 65% RH/70° F. and then tested. The results of these tests are shown in FIGS. 2 to 4. The lower curves in each figure represent data from solutions 1–5 while the upper curves represent data from solutions 1A to 5A.

It is apparent that at equal MCRA performance levels the tensile strength, tear strength and flex abrasion are markedly improved through the use of dimethyl sulfoxide as compared to the conventional manner of employing the nitrogen-containing, water-soluble cellulose reactive material, dimethylol ethylene urea.

EXAMPLE 2

Samples of several different cellulosic fabrics were treated by the method generally described in example 1 using test solutions and fabrics as indicated in the following Table I which reports the test results:

TABLE I

Fabric*	Pad Bath Composition %DMEU	%DMSO	MCRA Wet	Dry	Tensile Strength
Viscose	10	0	197	215	131
	10	20	208	220	134
Cotton	5	0	240	231	110
	5	10	249	226	119
Linen	5	0	254	210	53
	5	20	263	190	57

*Viscose = 100% viscose rayon challis
Cotton = 100% English broadcloth
Linen = 100% linen, handkerchief grade

DMEU = dimethylol ethylene urea
DMSO = dimethyl sulfoxide
Catalyst = 1% hydrated zinc nitrate

These data indicate that the observed improvements can be achieved with other cellulosic fibers than cotton and also with different cotton fabric constructions

EXAMPLE 3

Samples of cotton print cloth were treated as generally described in Example 1 using different nitrogen-containing, water-soluble cellulose reactive materials with and without dimethyl sulfoxide. The test results are shown in Table II.

TABLE II

Pad Bath Composition Reactant	DMSO	MCRA Wet	Dry	Tensile Strength
None	None	138	120	110
7.5% DMET	0	244	275	57
7.5% DMET	10	252	246	65
5% DMEU-OH	0	219	224	69
5% DMEU-OH	10	220	196	79
5% ET/MM	0	227	226	66
5% ET/MM	10	235	203	74

Reactants and Catalysts
DMET = dimethylol N-ethyl triazone with 1% hydrated zinc nitrate
DMEU-OH = dimethylol bis hydroxyethylene urea with 1% hydrated zinc nitrate
ET/MM = a 1:1 weight blend of DMET and tris methoxymethyl melamine with 1.2% magnesium chloride hexahydrate.

Although varying in extent, an improvement in the wet MCRA/tensile strength ratio was obtained with each material.

EXAMPLE 4

Samples of cotton print cloth were treated as described in Example 1 with 5 percent dimethylol ethylene urea, 1 percent hydrated zinc nitrate and different amounts of dimethyl sulfoxide as shown in Table III which reports the wet- and dry-crease recovery and tensile strength values of the dried and treated fabrics.

TABLE III

DMSO	MCRA Wet	Dry	Tensile Strength
0%	237	244	62
2.5%	240	244	67
5.0%	244	230	65
10.0%	245	233	70

The physical tests employed to evaluate the effects produced in the treated fabrics in the above examples are as follows. All values reported are the average of five replicate tests.

MCRA — Monsanto Crease Recovery Angle in degrees — total warp plus filling unless specified otherwise. Fed. Spec. CCC–T–191*b*, Method 5212.

Note: Wet MCRA values are obtained by soaking the test specimen in distilled water with 0.1 percent wetting agent at room temperature for 1 hour, blotting with blotting paper and testing as above.

Tensile Strength — Grab Method in pounds. Fed. Spec. CCC–T–191*b*, Method 5100.

Tear Strength — Elmendorf Method in grams. Fed. Spec. CCC–T–191b, Method 5132.

Abrasion Resistance — Cycles to Failure, C.S.I. Stoll Flex Tester, 1 lb. tension/1.2 lb. load. ASTM Method D1175–55T.

DISCUSSION OF DETAILS

The treating compositions used in carrying out the crease resistant improving procedures of this invention are aqueous solutions containing two essential ingredients, namely, (a) water-soluble, heat-curable, nitrogen-containing organic material known to possess crease-proofing properties when used in the treatment of cellulosic fabrics, and (b) dimethyl sulfoxide. The invention is preferably conducted using water-soluble amine-aldehyde reaction products known to be useful in the crease-proofing of cotton or other cellulosic fabrics. However, the invention is contemplated for use with any other form of nitrogen-containing, water-soluble organic materials now known to be useful for crease-proofing of cellulosic fabrics or found in the future to be useful for this purpose, e.g., water-soluble alkylated amine-aldehyde reaction products, aziridinyl phosphine oxides or comparable materials. Any of the nitrogen-containing, water-soluble, crease-proofing

agents, for example, mentioned in the patents listed in paragraphs 8 and 9 of this specification are contemplated as capable of being improved by use in combination with dimethyl sulfoxide in accordance with this invention.

Specific examples of nitrogen-containing, water-soluble, heat-curable organic cellulose fabric crease-proofing materials which may advantageously be used in accordance with the invention include:

From the class of amino-aldehyde reaction products, the monomers and water-soluble polymers of:

dimethylol urea
trimethylol melamines
dimethylol ethylene urea
dimethylol 1,3-propylene urea
dimethylol 5-hydroxy-tetrahydro-2(1H) oxopyrimidine
tetramethylol acetylene diurein
dimethylol formamide
dimethylol dihydroxy ethylene urea
and comparable
polymethylol melamines
polymethylol monoheterocyclic ureas
polymethylol acetylene diureins
polymethylol ureas.

From the class of alkylated amino-aldehyde reaction products, the monomers and water-soluble polymers of:

dimethoxymethyl urea
trimethoxymethyl melamine
dimethoxymethyl uron
diethoxy dihydroxy ethylene urea
methoxymethyl methylol formamide
ethyoxymethyl methylol N-methyl triazone
dimethylol N-ethyl triazone
dimethylol N-ethyl carbamate
tetramethylol dimethyl acetylene diurein
and comparable
polyalkoxy methyl ureas
polyalkoxy methyl melamines
polymethylol N-alkyltriazones
polymethylol N-alkyl carbamates
polyalkoxymethyl monoheterocyclic ureas.

From the class of aziridinyl phosphine oxides:

tris aziridinyl phosphine oxide
tris methyl aziridinyl phosphine oxide

The treating compositions used to impart wet- and dry-crease resistance to cellulosic fabrics in accordance with the invention are aqueous solutions containing dissolved therein the nitrogen-containing organic anti-crease agent, dimethyl sulfoxide and, preferably, in addition, an acidic aminoplast forming catalyst. Generally, the solutions will contain 1 to 20 percent of the nitrogen-containing agent, 1 to 20 percent dimethyl sulfoxide and 1 to 5 percent of the acidic catalyst.

Specific examples of acidic catalysts which may be used in accelerating the curing of nitrogen-containing compounds and reaction thereof with cellulose in the fabrics include zinc nitrate, magnesium chloride, zinc chloride, zinc fluoroborate and comparable acid-reacting metal salts. In addition, acid reacting salts of ammonia or amines may be used, e.g., ammonium silicofluoride, diammonium acid phosphate, ammonium bisulfate, ethanolamine hydrochloride and the like. Suitable catalysts also include free acids, e.g., hydrochloric, phthalic, tartaric, citric and similar acids.

No special form of equipment is required in carrying out the procedures of the invention. This constitutes and important advantage of the new procedures for it makes possible the easy addition of the operation to established textile finishing and handling plants. Likewise, generally available, commercially used drying, shaping and textile handling equipment may be employed in carrying out the drying, heating and dimension controlling steps of the new operations, Furthermore, the new procedures may be applied in conjunction with other textile processing operations generally considered useful by the textile industry. Such procedures include water-proofing, mildew-proofing, calendering, embossing, dyeing, printing and the like. Other known finishing agents not incompatible or detrimental to these new treatments may be applied in conjunction with the crease-proofing agents of this invention, e.g. lubricants, sizing materials, moth-proofing agents, water-proofing agents, brighteners, dyes, pigments and the like. Some or all of these types of materials may be included in the actual treating compositions of this invention in amounts advantageously about 1 to 10 percent. The new treating compositions may include other additional materials such as water-soluble cellulose swelling agents, which additional materials may comprise 0.1 to 25 percent of the treating composition and, advantageously, 1 to 10 percent.

The impregnation of the aqueous treating compositions is probably most easily accomplished by standard padding procedures although any other type of solution applicating procedure may be employed, e.g., spraying, brush application, roller coating, transfer from saturated webs or the like. Whatever procedure is employed, the fabric should be impregnated with sufficient of the aqueous composition so that when the fabric is completely dried, there will remain in the fabric as the nonvolatile residue, between about 1 and 20 percent of the nitrogen-containing, crease-proofing agent, and advantageously, 3 to 10 percent by weigh of the crease-proofing agent. With the preferred aqueous compositions, this can readily be accomplished by adjusting the impregnation to give a pickup of 50 to 100 percent by weight based upon the dried weight of the fabric or other fiber substrate to which the solution is applied.

Solution composition and fabric pickup is preferably controlled to place in the fabric before the curing step a nitrogen-containing, crease-proofing agent to dimethyl sulfoxide weight ratio of between about 10:1 and 3:20, and a weight ratio of the curing agent to curing catalyst of between about 5:3 and 1:20.

The aqueous solution impregnated fabrics or other fibrous webs are dried, preparatory to the heat curing step. This can be accomplished by air drying at room temperature using forced air circulation or, preferably, by heating such as with radiant or convection heat in ovens, tunnels or the like to an elevated temperature between about 50° and 100° C. and especially 100° to 150° C. for between about 1 to 60 minutes. The drying step need not be conducted any longer than necessary to effect substantial complete drying and, or course, generally shorter times will be required for higher temperatures.

After the substrate is dried, it is subjected to an elevated heating step in order to effect a curing which appears to involve a condensation of the solid residue materials in the fabric with themselves and with the cellulose. The heat curing is advantageously conducted at a temperature above 100° C. and below the decomposition temperature of the fabric, preferably between 100° and 200° C. and usually for between about 1 to 60 minutes, longer times generally being employed at the lower temperatures and vice versa. Drying and curing can take place at the same temperature if this is above about 100° C. and in the same oven or dryer if desired.

Following the heat curing step, it is advantageous to wash or scour the fabric in order to remove unreacted material. During this stage of the operations, it may be found desirable to treat the fabric with softening agents, sizing agents, lubricants or the like. Following this cleansing, the fabric is dried, preferably using some type of dimension control such as tenters or other dimension control frames or equipment to ensure even drying and squaring of the fabric.

The new crease-proofing operations are particularly useful for the finishing of cotton fabric which will be used for wearing apparel, such as men's shirts, women's dresses, children's clothing or the like, yard goods, sheeting and similar household fabric. However, the operations are also useful with any other form of fabric including non-woven as well as woven webs, knitted goods and the like composed of fibers of cellulosic origin, e.g., cotton, viscose rayon, acetate rayon, linen and the like. Cloth or other fibrous webs composed partially of fibers of cellulosic origin and partially of other natural or

synthetic fibers may also be treated, e.g., webs, containing in part, wool, silk, nylon, acrylic fibers, modacrylic fibers, polyester fibers and the like.

CONCLUSION

The invention described above provides new improvements in the general art of treating fabrics with nitrogen-containing, crease-proofing agents in order to render the fabrics anti-creasing and resistant to wrinkling. In a more popular sense, the described invention provides improvements in the manufacture of "wash and wear" cotton and other cellulosic textiles. The invention is characterized by the use of dimethyl sulfoxide as a critical ingredient along with conventional nitrogen-containing organic crease-proofing agents and is dependent upon the discovery that such use of dimethyl sulfoxide produces a critical improvement, as compared with prior known operations, in strength and other desirable properties of the treated fabric for the same level of wet and dry crease resistance. Notably, the tensile strength to crease resistance, tear strength to crease resistance and flex abrasion to crease resistant ratios of the treated fabrics are substantially increased as compared with prior art procedures.

The embodiments of the invention in which exclusive property or right is claimed are defined as follows:

1. A fabric treating composition for use in treating cellulosic fabrics to improve crease-resistant qualities thereof which comprises a mixture of:

A. dimethylol ethylene urea,

B. dimethyl sulfoxide in a weight ratio of A:B between about 10:1 and 3:20.

2. A fabric treating composition useful for crease-proofing cellulosic fabrics which comprises a mixture of the following active ingredients dissolved in water:

A. a water-soluble polymethylol cyclic urea reactive with cellulosic fabric to impart crease-resistant qualities thereto,

B. dimethyl sulfoxide and

C. acidic catalyst.

3. A fabric treating composition as claimed in claim 2 wherein the weight ratio of A:B is between about 10:1 and 3:20.

4. A fabric treating composition as claimed in claim 2 containing:

a. 1 – 20 percent of said polymethylol cyclic urea

b. 1 – 20 percent dimethyl sulfoxide

c. 1 – 5 percent acidic catalyst

5. A fabric treating composition as claimed in claim 2 wherein the polymethylol cyclic urea is dimethylol ethylene urea.

6. A fabric treating composition as claimed in claim 2 wherein the polymethylol cyclic urea is dimethylol dihydroxy ethylene urea.

7. A fabric treating composition as claimed in claim 2 wherein the polymethylol cyclic urea is dimethylol 1,3 - propylene urea.

8 A fabric treating composition as claimed in claim 2 which consists essentially of the said components A, B and C.

* * * * *