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PROCESS FOR IMPROVING CREASE-RETENTION PROPERTIES OF COTTON GARMENTS

Louis R. Mizell, Springfield, Md., assignor to Williamson-Dickie Manufacturing Company, Fort Worth, Tex., a corporation of Texas

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This invention relates to an improved process for treating cotton garments, to cotton garments having improved crease-retention properties and, more particularly, to a process for treating cotton garments to impart thereto improved crease-retention properties.

The use of various classes of chemicals or polymerizable resins for treating cellulosic textile materials, particularly cotton, to impart crease resistance and improved wash-and-wear properties thereto is well known. These chemicals and resins include formaldehyde, glyoxal, acrolein, various urea-formaldehydes including dimethylol cyclic ethylene urea resins (CEU), melamine and modified melamine formaldehydes, epoxy resins and others of the thermosetting resins which can be condensed with aldehydes or which can be polymerized on cotton with reaction to the cellulose molecules, or which can react without polymerization to cross-link cellulose molecules.

Fabrics treated in this manner also have other improved properties, such as better shrinkage control, quicker drying, resistance to rotting, etc. However, there are also certain undesirable effects from the use of these thermosetting resins, particularly the reductions in tear and tensile strengths and abrasion-resistance. One principal disadvantage is that pressed creases which are formed in the treated cotton fabrics or garments are not retained after a plurality of washes and, even after the first wash, the crease is not as well defined as it was prior to the washing step. Since the garments or fabrics already have been treated with a crease-resistant or wrinkle-resistant resin, it is extremely difficult to improve the appearance of the crease after the fabrics have been washed, since the fabric tends to resist the imparting of a crease thereto.

The importance of a commercial process which will enable creases to be applied to cotton garments, such as work-pants, work-shirts, pleated blouses and skirts, slacks, and the like, which creases will be substantially retained by the garments even after a plurality of washings and launderings, is readily evident.

Accordingly, it is an object of this invention to treat cotton garments to impart to them improved crease-retention properties.

Another object of this invention is to provide a process for forming on a cotton garment, a pressed crease which is resistant to a plurality of subsequent washings and which is still retained by the garment after these washings.

Still another object of this invention is to provide a cotton garment having a pressed crease formed therein, which crease is resistant to a plurality of launderings and is retained by the garment after each laundering.

In attaining the objects of this invention, one feature resides in impregnating the cotton garment with an aqueous emulsion of a mixture of cyclic ethylene urea-formaldehyde resin and from 1 to 2 parts by weight based on the weight of the resin of a butadiene-acrylonitrile copolymer having a 55% to 45% monomer ratio, respectively, extracting the excess mixture therefrom, forming a fold and heat-pressing along the line of fold to form a crease, and then curing the mixture of permanently set the crease therein.

Another feature resides in having the treated, creased

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garment contain about 5% by weight of the cyclic ethylene urea-formaldehyde resin and from about 5-10%, and preferably 8% by weight of the butadiene-acrylonitrile copolymer, based upon the weight of the dry garment prior to treatment.

Other objects, features, and advantages of the invention will be more apparent from the disclosure herein.

It has been found that a pressed crease may be formed in a cotton garment which crease is retained even after the garment is subjected to a plurality of washings or launderings, by first impregnating the garment with an aqueous emulsion containing from 1 to 2 parts of a butadiene-acrylonitrile copolymer (55%-45% monomer ratio) per each part of a dimethyl cyclic ethylene urea-formaldehyde resin, extracting the emulsion to about a 50-55% wet pick-up of liquor, forming a fold in the garment, heat-pressing the fold until dry and curing the mixture on the fabric, the amount of resin and copolymer used in the emulsion being such as to have retained on the finished product about 5% of resin and from about 5 to 10% of the copolymer. The crease-retention properties of the garment treated in the manner indicated above, even after numerous washings, are superior to the same properties in a fabric treated solely with the resin. However, when the amount of the elastomer is less than the amount of the CEU, namely 1% or 2% of the copolymer per 5% of the CEU resin, the crease retention properties of the garment are unsatisfactory.

The following example is merely illustrative of an embodiment of the invention, and is not to be considered as limiting the invention in any manner.

Example 1

An aqueous emulsion containing the following ingredients was prepared:

	Parts by weight
Cyclic ethylene urea-formaldehyde (Rhonite R-1) --	20
Butadiene-acrylonitrile (Chemigum 235 CHS) -----	39
Water -----	35
35% solution of zinc nitrate (Rohm & Haas Catalyst H-7) -----	2.3

Rhonite R-1 is the trademark of Rohm & Haas, Philadelphia, Pa., for its cyclic ethylene urea-formaldehyde resin (CEU), 50% solids, and Catalyst H-7 is also a trademark of the same company for its 35% solution of zinc nitrate catalyst preferred for use with its cyclic ethylene urea-formaldehyde. Chemigum 235 CHS is supplied by the Chemical Division of the Goodyear Tire & Rubber Company and is a butadiene-acrylonitrile copolymer having a monomer ratio of 55 parts of butadiene to 45 parts of acrylonitrile, with the average particle size of the material being 2,500 Angstroms. The product contains approximately 42% solids and the particles are dispersed in an aqueous medium with an anionic surface-active agent that gives the latex a high salt ion tolerance.

A pair of work pants made from tan, Type IV cotton twill cloth No. 9 was immersed in a bath of the above emulsion at room temperature for approximately a minute, until all parts of the garment were saturated. A longer immersion time is not harmful. The work pants were then removed and permitted to drain for a few minutes before being extracted to 50% pick-up of liquor based on the original dry weight of the garment, and then laid out smoothly on a steam press. The head of the steam press was held down until the pants were dry, after which the creased pants were hung vertically in a dryer and subjected to a temperature of 350° F. for five minutes, which cured the mixture and set the crease in the garment. The treated garment had an increased weight, based upon the dry weight of the garment, of approximately 13%, and the increase due to the presence of about 5% by weight of the

resin and of about 8% by weight of the butadiene-acrylonitrile copolymer.

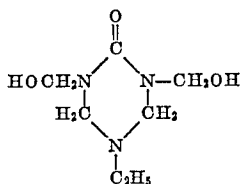
Several pairs of cotton twill work pants were treated in the manner disclosed in Example 1, except that the treated garments having the pressed crease therein had different proportions of resin and butadiene-acrylonitrile copolymers cured thereon, or else the garments were treated with the resin alone or elastomer alone. The garments were washed and tumble-dried once and the creases compared, and then were washed and tumble-dried a total of twenty times and the creases compared. The results are set forth in the following table:

Example	Treatment on Fabric	Percent Pressed Crease Retention	
		Laundried Once	Laundried 20 Times
2-----	Untreated-----	none	none
3-----	5% CEU-----	51	35
4-----	5% Butadiene-Acrylonitrile (Hycar 1571).-----	none	none
5-----	10% Butadiene-Acrylonitrile (Hycar 1571).-----	none	none
6-----	5% CEU, 5% Butadiene-Acrylonitrile (Chemigum 235 CHS).-----	89	77
7-----	5% CEU, 10% Butadiene-Acrylonitrile (Chemigum 235 CHS).-----	86	72
8-----	5% CEU, 10% Triazone-Formaldehyde.-----	47	none
9-----	5% Triazone-Formaldehyde.-----	45	none

From the above table, it will be noted that the pressed crease retention of the garments treated in accordance with the invention, Examples 6 and 7, is greater after being laundered twenty times than is the pressed crease retention of the fabric treated with the resin of Example 2 after only one laundering.

Since no resin was present for Examples 4 and 5, sodium aluminate was used as the curing catalyst in an amount equivalent to 0.5% of the rubber solids in solution.

The latex employed in Examples 4 and 5 is also a butadiene-acrylonitrile copolymer having a monomer ratio of 70-75 parts of the former to 30-25 parts of the latter, and is supplied by The B. F. Goodrich Company under its trademark Hycar 1571. The triazone of Examples 8 and 9 is formed by reacting a dimethyl urea with a primary amine, such as ethylamine, and then reacting the product, triazone, with two moles of formaldehyde, under alkaline conditions, to produce the wash-wear agent triazone-formaldehyde, having the formula:



When the term "cotton garment" is used in the above disclosure and in the claims, it is to be understood that it also includes garments containing a mixture of cotton and other fibers, but where the garment has most of the characteristics of a cotton garment, including the inability to retain a crease after one washing.

It will be apparent that for commercial applications, the aqueous material of Example 1 will contain a number of adjuvants, including a softener, such as silicone, polyethylene dispersion, cationic surface-active agent, etc., for imparting a soft hand and to improve tear strength and sewability of the fabric; a water-soluble polymer such as polyvinyl alcohol, modified starch or precondensed thermosetting resin, to impart a greater body to the fabric; a soft thermoplastic resin, such as acrylic resin, to improve the abrasion-resistance and tear strength ratio and to impart a soft, full hand; a silicone for durable softness and

resistance to water-borne stains; and other additives, including other softeners and lubricants, depending upon the properties desired in the cotton garment.

While zinc nitrate has been disclosed as the catalyst, other known catalysts for the CEU may be used.

Having fully described the invention, what is claimed is:

1. A process for forming, on a cotton garment, a pressed crease which is resistant to a plurality of subsequent washings and which is still retained by the garment after said washings, comprising, impregnating said garment with an aqueous emulsion of a mixture of one part cyclic ethylene urea-formaldehyde resin and from 1 to 2 parts by weight, based upon said resin, of a butadiene-acrylonitrile copolymer having a monomer ratio of 55 parts butadiene to 45 parts of acrylonitrile, extracting excess emulsion from said garment, forming a fold in said garment and heat-pressing said garment along the line of fold to form a crease therein, and subjecting said garment to a temperature sufficient to effect curing of the mixture thereon, said treated garment having about 5% by weight of cyclic ethylene urea-formaldehyde and from about 5 to 10% by weight of butadiene-acrylonitrile copolymer thereon, based upon the dry weight of the garment.

2. The process for forming, on a cotton garment, a crease which is resistant to a plurality of subsequent washings and which is still retained by the garment after said washings, as defined in claim 1, wherein the amount of said mixture remaining on said garment after said treatment is about 5% by weight of said cyclic ethylene urea-formaldehyde and about 8% by weight of the butadiene-acrylonitrile copolymer, based upon the dry weight of the garment.

3. The process for forming, on a cotton garment, a crease which is resistant to a plurality of subsequent washings and which is still retained by the garment after said washings, as defined in claim 1, wherein the amount of said mixture remaining on said garment after said treatment is about 5% by weight of said cyclic ethylene urea-formaldehyde and about 5% by weight of the butadiene-acrylonitrile copolymer, based upon the dry weight of the garment.

4. The process for forming, on a cotton garment, a crease which is resistant to a plurality of subsequent washings and which is still retained by the garment after said washings, as defined in claim 1, wherein the amount of said mixture remaining on said garment after said treatment is about 5% by weight of said cyclic ethylene urea-formaldehyde and about 10% by weight of the butadiene-acrylonitrile copolymer, based upon the dry weight of the garment.

5. A process for forming, on a cotton garment, a pressed crease which is resistant to a plurality of subsequent washings and which is still retained by the garment after said washings, comprising impregnating said garment with a mixture of one part cyclic ethylene urea-formaldehyde resin and from 1 to 2 parts by weight of a butadiene-acrylonitrile copolymer having a monomer ratio of 55 parts butadiene to 45 parts of acrylonitrile, extracting said emulsion until the weight of said garment is 50% greater than its dry weight, forming a fold in said garment and heat pressing said wet garment along the line of fold until dry to form a crease therein, and subjecting said garment to a temperature sufficient to effect curing of the mixture thereon, said treatment garment having about 5% by weight of cyclic ethylene urea-formaldehyde and from about 5% to 10% by weight of butadiene-acrylonitrile copolymer thereon, based upon the dry weight of the garment.

6. The process for forming, on a cotton garment, a crease which is resistant to a plurality of subsequent washings and which is still retained by the garment after said washings, as defined in claim 5, wherein the amount of said mixture remaining on said garment after said treatment is about 5% by weight of said cyclic ethylene urea-formaldehyde and about 8% by weight of the butadi-

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ene-acrylonitrile copolymer, based upon the dry weight of the garment.

7. The process for forming, on a cotton garment, a crease which is resistant to a plurality of subsequent washings and which is still retained by the garment after said washings, as defined in claim 5, wherein the amount of said mixture remaining on said garment after said treatment is about 5% by weight of said cyclic ethylene urea-formaldehyde and about 5% by weight of the butadiene-acrylonitrile copolymer, based upon the dry weight of the garment.

8. The process for forming, on a cotton garment, a crease which is resistant to a plurality of subsequent washings and which is still retained by the garment after said washings, as defined in claim 5, wherein the amount of said mixture remaining on said garment after said treatment is about 5% by weight of said cyclic ethylene urea-formaldehyde and about 10% by weight of the butadiene-acrylonitrile copolymer, based upon the dry weight of the garment.

9. A cotton garment having a crease formed therein and having improved crease-retention properties, said crease being resistant to a plurality of washings and being substantially retained by said garment after said washings, said garment having cured thereon, as the crease-retaining agent, a mixture of about 5% by weight of cyclic ethylene urea-formaldehyde and from about 5 to 10% by weight of butadiene-acrylonitrile having a monomer ratio of 55 parts butadiene to 45 parts acrylonitrile, said crease being formed in said garment prior to the curing of said mixture.

10. A cotton garment having a pressed crease formed therein and having improved crease-retention properties, said pressed crease being resistant to a plurality of washings and being substantially retained by said garment after said washings, said garment having cured thereon,

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as the crease-retaining agent, a mixture of about 5% by weight of cyclic ethylene urea-formaldehyde and about 5% by weight of butadiene-acrylonitrile copolymer having a monomer ratio of 55 parts butadiene to 45 parts acrylonitrile, said pressed crease being formed in said garment prior to the curing of said mixture.

11. A cotton garment having a pressed crease formed therein and having improved crease-retention properties, said pressed crease being resistant to a plurality of washings and being substantially retained by said garment after said washings, said garment having cured thereon, as the crease-retaining agent, a mixture of about 5% by weight of cyclic ethylene urea-formaldehyde and about 8% by weight of butadiene-acrylonitrile copolymer having a monomer ratio of 55 parts butadiene to 45 parts acrylonitrile, said pressed crease being formed in said garment prior to the curing of said mixture.

12. A cotton garment having a pressed crease formed therein and having improved crease-retention properties, said pressed crease being resistant to a plurality of washings and being substantially retained by said garment after said washings, said garment having cured thereon, as the crease-retaining agent, a mixture of about 5% by weight of cyclic ethylene urea-formaldehyde and about 10% by weight of butadiene-acrylonitrile copolymer having a monomer ratio of 55 parts butadiene to 45 parts acrylonitrile, said pressed crease being formed in said garment prior to the curing of said mixture.

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