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EL EXTRACTO DE LA PRESENTE SOLICITUD DE **PATENTE DE INVENCION**

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FECHA **30 DE JUNIO DE 2005** EL TERMINO HABIL EÑALADO POR LA LEY

EXPIRA EL **27 DE SEPTIEMBRE DEL 2005**

NOTA: Dentro del plazo de los seis (6) meses siguientes a partir de la fecha de publicación en la gaceta de Propiedad Industrial, deberá solicitar y cancelar el examen de patentabilidad so pena de que la solicitud caiga en abandono, de acuerdo con lo establecido en el Artículo 44 de la Decisión 486/2000.

SE PRESENTARON OPOSICIONES POR PARTE DE TERCEROS.

SI _____

NO__ _X_ _____



US005741548A

United States Patent [19]

Sanduja et al.

[11] Patent Number: **5,741,548**[45] Date of Patent: **Apr. 21, 1998**

[54] **COATING COMPOSITION FOR REEMAY
AND SATIN ACETATE FABRICS FOR LASER
PRINTABILITY**

[76] Inventors: **Mohan L. Sanduja**, 144-90 41 Ave.,
#516, Flushing, N.Y. 11355; **Isabella
Zilbert**, 2078 Cropsey Ave., Apt. 5A,
Brooklyn, N.Y. 11214; **Joel A.
Robinson**, 226 W. 37th St., New York,
N.Y. 10018; **Paul Thottathil**, 17 Bryant
Ave., New Hyde Park, N.Y. 11040

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[52] U.S. Cl. 427/261; 427/302; 427/303;
427/322; 430/31

[58] Field of Search 427/302, 303,
427/322, 261; 430/31

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,401,049 9/1968 Horowitz 117/47
3,698,931 10/1972 Horowitz 117/47 R
3,940,377 2/1976 Horowitz et al. 260/79.5
4,737,156 4/1988 Tambor et al. 8/495 X

5,156,906 10/1992 Holland 427/394 X
5,232,748 8/1993 Horowitz et al. 427/553
5,407,728 4/1995 Kerr et al. 428/195
5,431,501 7/1995 Hale et al. 400/120.02

Primary Examiner—Michael Lusignan

Attorney, Agent, or Firm—Steinberg, Raskin & Davidson,
P.C.

[57]

ABSTRACT

This invention relates to a polymeric composition for application onto Reemay and Satin acetate fabric for laser printability with a high level (90% or greater readability of printed characters, washability and enzyme rejection/retardation. The polymeric composition is applied by chemical grafting that involves the use of monomers/prepolymers, catalyst, graft initiator and other ingredients of the composition. The coating thus developed and subsequently applied to Reemay and Satin acetate fabric allows to undergo graft polymerization thereby forming a polymeric film which is chemically bonded to the fabric substrate with strong adhesion. The chemically grafted fabric is highly durable and permanent in terms of distinct legibility of the printed characters on the substrate after 55 launderings or 25 dry cleanings and has excellent level or enzyme rejection/retardation when the coated fabric with laser printed characters are subjected to an enzyme wash process.

15 Claims, No Drawings

5,741,548

1

COATING COMPOSITION FOR REEMAY AND SATIN ACETATE FABRICS FOR LASER PRINTABILITY

FIELD OF THE INVENTION

This invention relates to a fabric with a polymeric coating composition layer chemically bonded thereon for laser printability of images, so that an image printed on the fabric surface has improved readability and resistance to multiple washings. This invention is also related to chemical grafting methods for placing polymer layers on a fabric surface, and to improved methods for printing a durable, high resolution image on a fabric.

BACKGROUND OF THE INVENTION

Printing methods are often used to apply monochrome or multiple color images onto fabrics used for garments and other fabric products. Images imprinted on fabrics include different patterns such as, designs, numbers, letters and symbols. Such patterns may be printed by conventional printing press techniques, as well as computer controlled inkjet, bubble jet, phase change ink-jet printing (e.g., thermal printing) and xerographic based or laser printing.

It is well known in the art that there are limitations to obtaining a durable, high resolution image on fabrics having a weave pattern that limits the fine resolution of any image applied thereto. Further, printing inks or pigments generally do not adhere to a flexible fabric through many wash cycles. Thus, it is well known in the art to apply a surface preparation material to the fabric prior to the application of the desired primed image. Hale et al., in U.S. Pat. No. 5,431, 501, issued Jul. 11, 1995, teach a method for applying a surface preparation medium or binder, e.g., a polymer that may be applied by thermal printing methods to a fabric during a xerographic and/or inkjet priming process. The surface preparation medium or binder provides a layer that binds the printing inks to the fabric, and also serves to enhance the fine resolution of a printed image by reducing the roughness (from the weave pattern) of the surface to be printed on. However, such a conventional polymer coating on fabric still suffers the drawbacks inherent to previous methods, in that a number of washing or dry cleaning cycles will cause the printed image to degrade.

In one specialized use of fabric priming methods, characters and/or symbols are applied to labels to be attached to fabric products, e.g., garments. Such labels are typically printed on relatively smooth fabrics such as, e.g., Reemay (polyester) and Satin acetate fabrics. Such labels bear printed characters and/or symbols (e.g., bar codes), conveying information to the end user or to computerized scanning equipment.

Cellulose fabrics, used extensively in the fabrics industry, cannot be effectively used in conjunction with the laser printing technology. Characters printed on cellulose fabrics, using laser printing technology, are not of desirable clarity and quality to afford images suitable for bar coding registry and scanning. These laser printed characters do not endure multiple washes, dry cleaning and enzyme washes resulting in poor resolution and durability. It is important that the laser printed bar code characters have about 90% accuracy on a first read rate basis when scanned by computerized scanning equipment. This is true for the blue jeans industry which extensively uses both acid and alkaline enzyme washes during the production process. Enzyme washes are used in the blue jean industry to impart a faded look to the jeans.

In view of the above, there is a need to provide a process for printing characters using laser technology such that these

2

characters endure multiple washings, including enzyme washes, and still provide high quality characters with desirable clarity and quality thereby providing better than about 90% accuracy when scanned by computerized scanning devices.

SUMMARY OF THE INVENTION

Generally speaking in accordance with the present invention, polymers are grafted onto substrates, such as fabrics. This grafting of polymeric material onto fabrics is achieved by chemical bonding of the polymers to the fabric substrate molecules through covalent bonding. The procedure generally involves reacting monomers having at least one acidic proton with a Graft Initiator (GI).

The acidic proton from the monomer is removed by the GI, thereby forming a monomer radical. The monomer radical then initiates the formation of polymer chains.

It is accordingly a primary object of the present invention to provide fabric material having a coating of polymeric material which is chemically bonded to the fabric.

It is a further object of the present invention to provide a method of treating a fabric surface to enhance the resolution of images imprinted thereon when scanned by a machine, such as computerized scanning devices.

Yet another object of the present invention is to provide a fabric coated with a material capable of adhering to the laser printer toner so as to assure legibility of printed characters especially after multiple washings of the fabric, i.e. the useful life of the garment.

It is yet another object of the present invention to provide laser-printed characters on fabric especially cellulose fabric of high clarity to enable bar coding registry and scanning of characters by computerized scanning devices of the bar code symbols after several washings and dry cleanings.

Other objects and advantages of the present invention will be apparent from a further reading of the specification and the claims.

This invention is applicable to any suitable fabric material, including acetate, polyester, polypropylene fabric, nylon, polyester, fiberglass, acrylic, cellulose, polyethylene, Teflon™, polyvinyl chloride, polycarbonate, and the like.

The method of the instant invention provides for a fabric having a polymer layer grafted on the fabric surface wherein images printed on the polymer layer retain about 90% machine readability after about 55 washings or about 25 dry cleanings. The washings can be conducted, e.g., with a solution comprising a laundry detergent. The resulting fabric can be cut into any suitable size or shape, including a label or a tag.

A graft initiator is used to activate the fabric surface and start the polymerization reaction. The graft initiator includes an effective concentration of a metal ion selected from Fe⁺², Fe⁺³, Ag⁺, Co⁺², Cu⁺² and a peroxide such as urea peroxide, benzoyl peroxide, and the like.

The invention is also related to a fabric having a grafted polymer surface thereon, with a printed image on said surface, comprising a polymer layer chemically bonded to the fabric surface. Further, the polymer surface has a printed image comprising printed characters or symbols on the surface.

The fabric according to the invention has a grafted polymer layer prepared by a process that includes treating a fabric surface with a graft initiator effective to chemically activate the fabric surface. The chemically activated surface is then contacted with a reagent that includes a polymeriz-

able monomer or prepolymer that reacts with the activated fabric surface to form a polymer layer grafted, i.e., chemically bonded, onto the fabric surface. The polymerization reaction is then terminated by radical combination after the polymer layer is grafted to the fabric surface. The fabric to be treated includes, e.g., acetate, polyester, nylon, polyester, fiberglass, acrylic, cellulose, polyethylene, polyvinyl chloride, polycarbonate, and the like and can be in the form of a label.

Accordingly, the present invention provides a method for preparing a fabric surface for printing thereon, so that an image so printed has improved readability and resistance to multiple washings, wherein a polymer material is chemically grafted onto the fabric surface to form a polymer layer.

The method provided by the present invention for the chemical grafting of the polymer material onto the fabric surface comprises:

- (a) treating a fabric surface with an effective graft initiator producing a chemically activated fabric surface;
- (b) contacting the activated fabric surface with a reagent comprising a polymerizable monomer or pre-polymer to produce a polymer layer grafted fabric surface; and
- (c) terminating the chemical grafting by radical combination after the polymer layer is grafted onto the fabric surface.

DETAILED DESCRIPTION

Accordingly, the invention provides a method to have a polymer layer chemically bonded or grafted directly to a fabric surface. This method, where a "foreign material" becomes attached to another material by means of a chemical bond is referred to as "chemical grafting". One example is the production of acrylonitrile-butadiene-styrene (ABS) obtained by the direct grafting of styrene-acrylonitrile on a polybutadiene backbone. This often is achieved by the polymerization of styrene and acrylonitrile in the presence of butadiene.

Chemical grafting might be visualized as the growth of "whiskers" onto a material. These whiskers are joined to the basic material (which is referred to as the substrate) by means of a chemical bond. This is a much stronger bonding than that provided by ordinary chemical "coatings" where the bond between the substrate and the coating is only physical in nature.

Chemical grafting is believed to involve, as a first step, the activation of the substrate, i.e., the fabric to be treated. Once the substrate has been activated, chains of monomers linked by carbon-carbon bonds grow on the substrate resulting in the whiskers. These whiskers permanently impart new and desirable properties to the substrate without damaging any of the existing positive characteristics of the substrate.

The basic process of grafting a polymeric layer to a substrate material, including fabrics, has been the subject of patent applications by the assignee of the present invention and include, e.g., U.S. Ser. Nos., the disclosures of which are incorporated herein by reference in their entireties. This technology is applicable to liquids or solids, be they yarns, fabrics, films; solutions, emulsions, etc. As a result of chemical grafting, the materials possess new and desirable properties, permanently.

In each instance, use is made of one or more of the hundreds of monomers which are commercially available at the present time. In addition, many more are readily obtainable by simple means. Typically, no new equipment or processing steps are required for carrying out the process.

This method differs from many other methods of chemical grafting which require radiation, high or low pH, plasma treatment, flaming or other extremely harsh, expensive and cumbersome reaction conditions.

Where possible, the reactions of the invention make use of emulsions or aqueous solutions to minimize environmental release of organic solvents. Toward this end, methods have been developed to solubilize the necessary organic materials in water. In addition, the reactions typically exhaust the organic reactants, leaving little or no organic waste.

The grafting process thus provides a means for altering the surface chemistry of a fabric, in effect creating fabrics with useful "hybrid" properties. For example, among the "permanent" properties that can be added to a fabric are nonflammability, abrasion resistance, soil repellency, improved adhesion to fabric, ion-exchange capability, ultraviolet protection, water absorbency, gas impermeability, bactericidal, fungicidal, and the like. The areas of application of the resultant materials include textiles, plastics, pollution control, bio-material, etc.

Accordingly, the present invention provides a method for preparing a fabric surface for printing thereon, so that an image so printed has improved readability and resistance to multiple washings, wherein a polymer material is chemically grafted onto the fabric surface to form a polymer layer.

The method provided by the present invention for the chemical grafting of the polymer material onto the fabric surface comprises:

- (a) treating a fabric surface with an effective graft initiator producing a chemically activated fabric surface;
- (b) contacting the activated fabric surface with a reagent comprising a polymerizable monomer or pre-polymer to produce a polymer layer grafted fabric surface; and
- (c) terminating the chemical grafting by radical combination after the polymer layer is grafted onto the fabric surface.

The method provided by the present invention can be used on fabrics selected from a group comprising acetate, polyester, polypropylene, nylon, polyester, fiberglass, acrylic, cellulose, polyethylene, polypropylene, Teflon™, polyvinyl chloride, and polycarbonate. The fabric can be in the form of a label or a tag.

Another aspect of the present invention provides a method of printing an image on the polymer layer of a fabric surface which retains about 90-95% machine readability after about 55 washings or about 25 dry cleanings. The washings are done using a solution comprising one or more laundry grade enzymes.

Also provided by the present invention is a method for preparing a fabric surface for printing thereon wherein the monomer or pre-polymer comprises a functional moiety selected from the group consisting of hydroxyl, carboxyl, epoxy, amide, amine, anhydride, vinyl or a acrylic compound.

In yet another aspect of the present invention is provided a method wherein the graft initiator comprises an effective concentration of a peroxide compound. The peroxide compound is selected from urea peroxide and benzoyl peroxide.

In a further embodiment of the present invention is provided a method wherein an image is printed using a xerographic or laser printing method. The image so printed comprises characters or symbols.

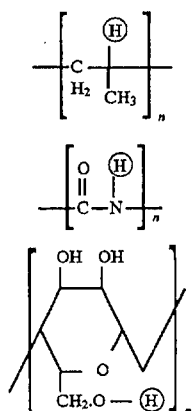
Polymerization Reactions

Many materials, both naturally occurring and synthetic, possess hydrogens which are more reactive than the "bulk

5,741,548

5

hydrogen". Examples of reactive hydrogens are the tertiary hydrogen in polypropylene (I), the amide hydrogen in proteins (II), and the hydroxyl hydrogen in polysaccharides (III), as shown below:



Graft-initiators (GI), such as Ferrous ions (Fe^{++}) derived from Ferrous Ammonium Sulfate, and other metal ions such as Ag^+ , Co^{++} , Cu^{++} , derived from their respective salt solutions, have the capacity of removing these active hydro-

6

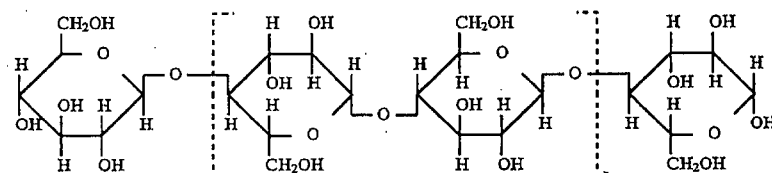
fact that the methods of the present invention can use a radical, anion or cation broadens the scope of this invention. In the instant invention represents a vinyl



monomer unit where "X" governs the property or properties associated with the monomer. In many instances, a mixture of monomers is employed and often more than one property can be imparted to the fabric surface in one step. These polymer chains, whose length can be controlled, are permanently attached to the fabric "substrate". The linkage between the polymer and the substrate is covalent in nature. The graft polymer chains are formed from vinyl monomers or monomers containing appropriate polymerizable functionality, e.g., groups such as hydroxyl, carboxyl, epoxy, amide, amine, a hydride and so forth.

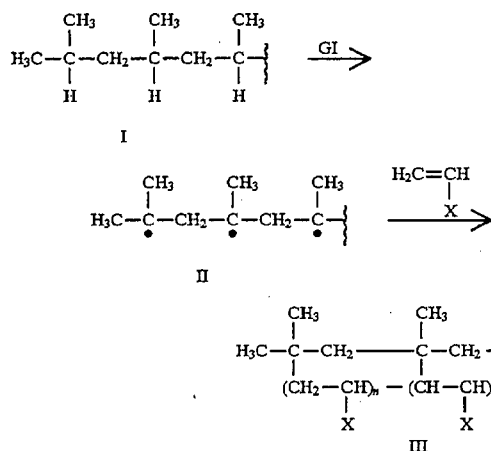
Cotton is a commonly used textile fiber which comprises from about 88% to about 96% cellulose. Cellulose is a natural carbohydrate (polysaccharide) consisting of anhydrous glucose units joined by an oxygen linkage forming essentially linear molecular chains as depicted in FIG. 2:

FIG. 2



gens and concomitantly initiating the growth of polymer chains at the site from where the active hydrogen was removed. In the case of polypropylene, this can be represented as follows:

FIG. 1



In FIG. 1, • can represent either a free radical, anion or cation, depending on whether the GI removes a hydrogen and one electron, no electrons or two electrons, respectively. There are wide variety of monomers which do not lend themselves to the free-radical type of polymerization. The

It is difficult to have long lasting clear and readable images printed on a cotton surface. Grafting a polymer layer onto the surface of a cotton fabric enhances the quality of images printed on the fabric surface.

Grafting of a cotton fabric surface with a polymeric layer can be described as a process comprising activating the cellulose molecule, attaching monomers at the reactive sites followed by chain propagation.

In particular, the process of chemically grafting a polymeric layer to a cotton fabric surface comprises abstraction of the (acidic) hydrogen atom from a hydroxy group of the cellulose molecule forming a free radical. The free radical initiates the process of chemically grafting a polymeric layer onto the fabric surface.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following examples illustrate various aspects of the present invention. They are not to be construed to limit the invention or the claims in any manner whatsoever.

EXAMPLE 1

METHOD OF PREPARATION OF THE FORMULATION

The method according to the invention is used to prepare a stock formulation fabric for use as printed labels. A precalculated quantity of a desired acrylic prepolymer was taken in a container and to it were added monomers, prepolymers, catalyst, graft initiator and other ingredients of

5,741,548

7

the composition. Each ingredient was taken in a concentration ratio by weight as indicated in the composition shown in either Table 1, 2 or 3, below. The contents were stirred to a uniform solution.

Formulation Parameters

Total percentage (%) of solids—about 45.0% minimum;
pH—9.0 minimum;
Color—Stable at processing conditions
Formulation free of entrapped air.

Coating Line

Cure pass conditions: about 45 seconds at about 325° F.; and about 90 seconds at a maximum of about 340° F.

OC Testing

AATCC 61-1994

Accelerated Laundering: Coating integrity and print retention free from blocking, stiffness and pinholes.

Examples of Preferred Embodiments:

The following examples illustrate the invention, however, the scope of this invention is not limited to the specific details of the examples.

EXAMPLE I

PARTS BY WEIGHT	
Acrylic prepolymer Joncryl Scx 2560	90.00
Urethane prepolymer Resamine UMT 171	10.00
Sodium salt of AMPS monomer	0.20
Urethane acrylate SR9035	0.15
Sodium vinyl sulfonate	0.05
Urea peroxide (0.1% solution)	0.01
Ferrous Ammonium sulfate (0.1% solution)	0.01
Viscosity = 285-300 cps	

EXAMPLE II

Acrylic prepolymer Joncryl Scx 2560	90.00
Urethane prepolymer Resamine UMT 171	10.00
Polysulfonic Acid	
Thickner Rheothick 80-11	3.20
Sodium salt of AMPS monomer	0.20
Urethane acrylate SR9035	0.15
Urea peroxide (0.1% solution)	0.01
Ferrous Ammonium sulfate (0.1% solution)	0.01
Viscosity = 6,000 cps	

EXAMPLE III

PARTS BY WEIGHT	
Acrylic prepolymer Joncryl Scx 2560	
Urethane Prepolymer Resamine UMT 171	40.00
Polysulfonic Acid	
Thickening agent Rheothick 80-11	20.00
Sodium salt of AMPS monomer	0.80
Monomer urethane acrylate SR9035	0.60
Monomer sodium	0.20

8

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PARTS BY WEIGHT	
Vinyl sulfonate	
Urea peroxide (0.1% solution)	0.04
Ferrous Ammonium sulfate 0.1% solution	0.04
Viscosity = 20,000 cps	

10 We claim:

1. A method for improving the printability of a fabric, said method comprising the steps of:

(a) contacting a fabric surface with a graft initiator to produce a chemically activated fabric surface;

15 (b) contacting the activated fabric surface with a reagent comprising a polymerizable monomer or pre-polymer to produce a polymer layer grafted fabric surface; and
(c) terminating the chemical grafting by radical combination after the polymer layer is grafted onto the fabric surface.

20 2. A method of claim 1 wherein the fabric is selected from a group consisting of acetate, polyester, polypropylene, nylon, fiberglass, acrylic, cellulose, polyethylene, polypropylene, Teflon™, polyvinyl chloride, and polycarbonate.

25 3. A method of claim 2 wherein the fabric is selected from a group consisting of acetate and polyester.

4. A method of claim 3 wherein the fabric is in the form of a label or a tag.

30 5. A method of claim 1 wherein the monomer or pre-polymer comprises a functional moiety selected from the group consisting of hydroxyl, carboxyl, epoxy, amide, amine, anhydride and vinyl.

35 6. A method of claim 1 wherein the monomer or pre-polymer comprises an acrylic compound.

7. A method of claim 1 wherein the graft initiator comprises an effective concentration of a peroxide compound.

8. A method of claim 7 wherein the peroxide compound is selected from urea peroxide and benzoyl peroxide.

40 9. A method of forming an image on a fabric, said method comprising the steps of:

(a) contacting a surface of said fabric with a graft initiator to produce a chemically activated fabric surface;

45 (b) contacting said activated fabric surface with a reagent comprising a polymerizable monomer or prepolymer to produce a polymer layer grafted onto said fabric surface; and

(c) printing an image onto said polymer layer.

50 10. A method of claim 9 wherein said image printed on the polymer layer of said fabric surface retains about 95% machine readability after about 55 washings or about 25 dry cleanings.

11. A method of claim 10 wherein the washings are done using a solution comprising one or more laundry grade enzymes.

12. The method of claim 9 wherein said step of printing comprises xerographic printing.

60 13. The method of claim 9 wherein said step of printing comprises laser printing.

14. The method of claim 9 wherein said image is a bar code.

15. The method of claim 9, said method further comprising terminating said grafting of said polymer layer onto said fabric surface by radical combination.

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US006102973A

United States Patent [19]
Morales

[11] **Patent Number:** **6,102,973**
[45] **Date of Patent:** **Aug. 15, 2000**

[54] **PROCESS FOR TREATING GARMENTS**

[76] Inventor: **Rodolfo A. Morales**, 9921 Goby, El Paso, Tex. 79924

[21] Appl. No.: **08/538,172**

[22] Filed: **Aug. 23, 1995**

Related U.S. Application Data

[63] Continuation of application No. 08/086,811, Jul. 20, 1993, abandoned.

[51] Int. Cl.⁷ **D06M 13/322**

[52] U.S. Cl. **8/185; 8/181; 8/182; 8/184; 8/186; 8/187; 8/188; 8/115.6; 8/115.7; 8/149.3; 8/115.58; 223/57; 38/144**

[58] Field of Search **8/181, 182, 184, 8/185, 186, 187, 188, 115.6, 115.7, 149.3, 115.58, 918; 223/57; 38/144**

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,208,301	6/1980	Gammon	252/321
4,396,391	8/1983	North	8/181
4,447,241	5/1984	Hendrix	8/182
5,013,378	5/1991	Farah	156/226

OTHER PUBLICATIONS

Turner, "Improving Durable Press Properties of Garment Dyed Goods", Cotton Incorporated, Feb. 25, 1988, pp. 1-9.
Barbery, "Garment Finishing", AATCC Symposium, Long Beach, CA, Nov. 8, 1991, pp. 1-7.

Two Recent Developments in Durable Press Finishing of Cotton Fabrics, John D. Turner, (Date Unknown).

A Pressing Need for a New Wrinkle—DP Finishing of Garment Dyed Products, Richard Brown Charles Tomasino Jimm C. Barbery John D. Turner and Don Jones, (Date Unknown).

Garment Finishing, Jimm C. Barbery, AATCC Symposium Long Beach, CA, Nov. 8, 1991.

Improving Durable Press Properties of Garment Dyed Goods, John D. Turner, Cotton Incorporated, Feb. 25, 1988.

Appearance of Durable Press Fabrics After Repeated Home Laundering, AATCC Technical Manual, (Month Unknown) 1988.

Appearance of Creases in Durable Press Items After Repeated Home Laundering, AATCC Technical Manual, (Month Unknown) 1988.

Primary Examiner—Alan Diamond

Attorney, Agent, or Firm—Alston & Bird, LLP

[57] **ABSTRACT**

A method for imparting durable press and softness characteristics to garments. The initial step of the process is to start with a garment in which the pH is between about 6 and 7. The garments are immersed in a mixture of water, a non-ionic wetter, a glyoxal resin and aminofunctional silicone, and a cationic HDPE in specific amounts, depending upon the type of fabric of which the garments are made. The mixture is extracted from the garments to a specific extent. After mixture extraction, the garments are pressed and baked.

12 Claims, No Drawings

6,102,973

1

PROCESS FOR TREATING GARMENTS

This application is a Continuation of application Ser. No. 08/086,811, filed Jul. 20, 1993 now abandoned.

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to processes and methods for treating garments. In particular, the invention relates to the treatment of garments made of cotton, cotton blends and synthetic fabrics for the purpose of imparting durable press properties thereto.

A variety of techniques and additives have been suggested for use in the treatment of such fabrics to obtain durable press properties. Suggestions include those contained in a paper entitled *Garment Finishing* by Jimm C. Barbary, dated Nov. 8, 1991 AATC Symposium, Long Beach, Calif. Barbary suggests the use of a precatalysed low-formaldehyde glyoxal resin (10%), a non-ionic wetter (0.2%), an amino-functional silicone (3%), a cationic high density polyethylene (2%), and acetic acid—56% (0.1%) in aqueous solution wherein water comprises the remaining 84.7%. Barbary suggests loading the machine with the garments prior to the addition of the liquid mix components. Barbary also suggests that once the mixture components are added, the garments be allowed to soak for between six and ten minutes without agitation. Finally, Barbary suggests that the garments be pressed and cured.

In a paper entitled *A Pressing Need for a New Wrinkle—DP Finishing of Garment Dyed Products*, by Richard Brown, Charles Tomasino, Jimm C. Barbary, John D. Turner and Don Jones (date of publication unknown), published by the research committee of the Northern Piedmont Section of AATCC, the authors thereof suggest that a process similar to the one described in the Barbary paper be applied to garments which have been garment dyed. Again, the AATCC paper, the use of acetic acid (56%) is suggested. The AATCC paper describes a formulation containing methylated DMDHEU (dimethylol dihydroxyethylene urea) and does not indicate that a functional silicone was used.

In a paper entitled *Two Recent Developments in Durable Press Finishing of Cotton Fabrics* by John D. Turner of Cotton, Inc., (date of publication unknown), Turner suggests the use of amino silicone alone and, as an alternative, in combination with diethylene glycol and coco-diethanolamide. In addition, Turner suggests the addition of acetic acid (100%) in the amount of 0.2% as a percentage of the bath weight. The Turner formulation also included high density polyethylene. The Turner process is directed to fabrics, not garments, as evidenced by Turner's concern about sewing lubrication.

In another paper by Turner of Cotton, Inc. entitled *Improving Durable Press Properties of Garment Dyed Goods*, dated Feb. 25, 1988, Turner suggests the use of etherified DMDHEU (5%–15%), magnesium chloride hexahydrate (1.5%–4.0%), acetic acid (0.1%–0.2%), and a polyethylene softener (2.0%–5.0%). The finish mixture is applied to garments which are still wet from the dying process. Turner does not suggest the use of any wetting agent. Since the garments treated in the Turner process are already wet from the dying process, determining the proper formulation is difficult and the degree of agitation required to ensure the proper amount of resin is deposited in the garments is difficult and imprecise.

The processes and methods of the present invention constitute an improvement upon the foregoing techniques.

2

In particular, the present invention provides a commercially practicable method for imparting durable press characteristics to fabrics containing cotton. Garments treated by the methods set forth herein may be made to have durable press and softness characteristics which are both superior and consistent from batch to batch.

The present invention provides a technique for maximizing the durable press characteristics while maintaining an acceptable level of garment wear and durability.

BRIEF DESCRIPTION OF THE INVENTION

Improved durable press and softening characteristics can be obtained in garments by following a procedure in which the garments initially have a fabric pH of between 6 and 7. The garments should be clean, absorbent and free of size, waxes, loose dyes and the like. In the case of garments made of denim the garments should be pre-washed, and, if desired, a stone wash or enzyme wash may be used. Depending upon the percentage of cotton, if any, in the fabric comprising the garment, different amounts of precatalyzed, low-formaldehyde glyoxal resin and cationic amino functional silicone in an aqueous emulsion are used. Further, depending upon whether the garments contain dyes, a defoamer and a dye fixer will be used. In all cases, a linear alcohol non-ionic detergent is added to the mixture as a wetting agent. After the garments have been treated with a mixture containing the foregoing components in appropriate proportions, the garments are dried to a specific degree, i.e. between 11% and 15% moisture content to make sure that proper amounts of the components of the mixture remain with the garment. Before the garments are allowed to dry further, for example, before approximately 12 hours have passed depending on the weight of the fabric, the garments are pressed in accordance with a procedure more thoroughly described herein. Finally, the garments are pressed and cured by being exposed to relatively high temperature of between approximately 290° F. and 320° F. By following the procedures set forth herein, excellent results have been obtained in producing garments having durable press characteristics, even in garments which contain up to 100% cotton.

DETAILED DESCRIPTION OF THE INVENTION

The first step in practicing the present invention is to make sure that the garments to be treated have a pH in the range of between 6 and 7, and that the alkalinity of the garment is less than about 0.05% (as NaOH). The garments must be clean, absorbent, free of size, waxes and loose dyes. As used herein, the term "garment" is intended to refer to articles of clothing including slacks, shirts, and other similar items for which durable press and softness characteristics may be desirable. Most suppliers of non-denim fabric can produce fabrics in accordance with these requirements. However, it has been found that denim suppliers have difficulty meeting such requirements. Therefore, it is often necessary to wash denim products prior to their being treated for durable press characteristics. As a practical matter, however, because of fashion concerns, most denim products are now required to be pre-washed in some manner, either with a stone wash process or an enzyme wash process, and the requirement that denim garments be treated in order to maintain the proper pH is not a significant problem.

Garments with the proper pH, i.e. between 6 and 7, are immersed in a mixture generally comprising some combination of the following components:

Component A: a wetting agent, preferably a linear alcohol ethoxylate, which is non-ionic and highly biodegradable;

6,102,973

3

Component B: a glyoxal resin, preferably a glycolated DMDHEU (dimethylol dihydroxethylene urea), with a magnesium chloride catalyst, and containing extremely low levels of formaldehyde (less than 0.5%);

Component C1: a high density polyethylene in an aqueous emulsion with cationic emulsifiers;

Component C2: a high density polyethylene in an aqueous emulsion with non-ionic emulsifiers;

Component D1: a cationic amino functional polysiloxane in an aqueous emulsion, preferably containing a fatty-amine chemically tied to the backbone of the polysiloxane;

Component D2: an aqueous emulsion of silicone fluid made with non-ionic emulsifiers;

Component E: (for colored garments only), a defoamer, preferably a composition of high molecular weight paraffinic oil and alkoxylated surfactants of polyether ester character;

Component F: (for colored garments only), a dye fixer, preferably an aqueous solution of a cationic polymer.

The above components, when called for to meet a particular application, are combined with water in a garment washing machine. Generally, the components are added one at a time while the machine is stopped, and with the water added first. Without the garments in the machine, the components and the water are mixed with regular agitation for approximately 3 to 4 minutes. After the components are mixed thoroughly in water, the garments are added to the machine. The garment and mixture are mixed together for approximately 10 minutes. However, when garments made of sanded or brushed fabrics are being treated, no agitation should be used. Care should be taken not to add garments to the machine until the components of the mixture are thoroughly mixed with the water. A small amount of water, about 15 gallons, should be reserved to rinse containers used to transport the other components to the machine.

The polysiloxane listed above as component D1 and the silicone fluid listed above as component D2 are examples of silicon based polymers which may be used to provide the garment with a soft feel.

The foregoing generally described invention is exemplified by the following examples which are illustrative of the invention:

EXAMPLE 1

For treating white 100% cotton fabric garments with fabric weights of various types, not including denim, a mixture containing the following amounts of the above-described components was prepared:

Component:	Percent of Mixture by Weight:
A (wetting agent)	0.1%
B (glyoxal resin)	9.0%
C2 (HDPE)	3.0%
D2 (silicone fluid)	3.0%
Water	84.9%

For non-denim fabrics which are white, the foregoing formulation should be without the addition of a dye fixer (Component F). In addition, since foam control products tend to cause yellowing in white fabrics, the preferred formulation for white garments made of 100% cotton does not include a defoaming agent.

EXAMPLE 2

The second example of the present invention is one for use with 100% cotton, non-denim garments which contain

4

dye fabric. In this example, a mixture of the following amounts of the above described components were prepared. A dye fixer, approximately in the amount of 0.5% of the total weight should be added in order to help prevent fading due to the loss of dye from the garments.

Component:	Percent of Mixture by Weight:
A (wetting agent)	0.1%
B (glyoxal resin)	9.0%
C1 (HDPE)	3.0%
D1 (polysiloxane)	3.0%
Water	84.9%

EXAMPLE 3

Garments made of 100% cotton which are non-denim and which are brushed or sanded goods) should be treated with a mixture as follows:

Component:	Percent of Mixture by Weight:
A (wetting agent)	0.1%
B (glyoxal resin)	9.0%
C1 (HDPE)	3.0%
D1 (polysiloxane)	6.0%
Water	81.9%

The foregoing mixture should be used without a defoamer or dye fixer for garments which do not contain dyes i.e. white garments. However, as discussed with respect to Example 2 above, a dye fixer in the amount of approximately 1.5% should be added to dyed garments. No agitation of the garments in the mixture should be done. Agitation of brushed or sanded garments may detrimentally affect the appearance and hand of the garments.

EXAMPLE 4

Garments made of 100% cotton denim should be treated with a mixture as follows:

Component:	Percent of Mixture by Weight:
A (wetting agent)	0.1%
B (glyoxal resin)	7.0%
C1 (HDPE)	3.0%
D1 (polysiloxane)	6.0%
Water	83.9%

As discussed above with respect to Example 1, the foregoing mixture should be used with white garments. However, as discussed with respect to Example 2, if garments containing dye are to be treated, a dye fixer in the amount of approximately 1.5% should be added.

EXAMPLE 5

Garments made of a blend of cotton and polyester may be treated with a mixture which contains somewhat less resin

5

than the 100% cotton non-denim garments discussed in connection with Examples 1 through 3. The mixture for blends should contain the following components in the following amounts:

Component:	Percent of Mixture by Weight:
A (wetting agent)	0.1%
B (glyoxal resin)	7.0%
C1 (HDPE)	3.0%
D1 (polysiloxane)	3.0%
Water	86.9%

As discussed above with respect to Example 2, the foregoing mixture without defoamer or dye fixer should be used for white garments. If garments containing dye are to be treated, a dye fixer in the amount of approximately 1.5% may be added.

EXAMPLE 6

For garments which are made of synthetic materials, such as 50% polyester and 50% rayon, or 50% polyester, 25% rayon and 25% acrylic, should be treated with a mixture containing the following components in the following amounts:

Component:	Percent of Mixture by Weight:
A (wetting agent)	0.1%
B (glyoxal resin)	7.0%
C1 (HDPE)	3.0%
D1 (polysiloxane)	1.5%
Water	88.4%

As discussed above with respect to Example 2, the foregoing mixture without defoamer or dye fixer may be used for white garments. If garments containing dye are to be treated, a dye fixer in the amount of approximately 1.5% may be added.

After the garments have been agitated, or soaked in the case of garments made of brushed or sanded fabrics, in the treatment mixture for the specified period of approximately 10 minutes, the mixture is extracted from the garments so as to leave the garments with between about 70% and 80% wet pick-up, based on the dry weight of the garments. For example, a load of dry garments weighing 1000 lbs. before being immersed in the treatment mixture should weigh between about 1700 lbs. and 1800 lbs. when they are unloaded after extraction of the mixture and before being dried in a dryer.

It should be noted that the C and D components, i.e. the HDPE and the silicon based polymers, respectively, should be matched with each other with regard to their ionic character. In Example 2 the C1 component and the D1 component are both cationic, and in Example 1, the C2 and D2 components are both non-ionic. In all cases, the effectiveness of the various components is best if the use of anionic and cationic components in the same mixture is avoided. Thus, a non-ionic wetting agent may be used with the mixture of both Example 1 (non-ionic) and Examples 2 through 6 (cationic).

6

A defoamer, Component E, in an amount approximately 0.1% of the total weight, is added. A defoamer known as VERCODEFOAMER NS-200 available from Virkler of Charlotte, N.C., has been found to be an effective defoamer for purposes of practicing the present invention. The manufacturer describes VERCODEFOAMER NS-200 as being a synergistic composition of high molecular weight paraffinic oils and alkoxylated surfactants of polyether ester character. The specifics of the molecular weight and other details of the defoamer are not known. It may not be necessary to add a defoamer to the mixture itself. It may only be necessary to add a defoamer to the portion of the mixture which is left over after the garments have been treated (waste liquid). A defoamer added to the waste liquid will minimize foaming for purposes of discarding the waste liquid into a system which eventually cleans or treats the waste liquid at a waste water treatment location.

The garments treated in accordance with the foregoing examples should all be dried to between approximately 11% and 15% moisture as measured by a portable moisture monitor, such as one available from the Strandberg Engineering Laboratories, Inc. If the garments are dried beyond this moisture content level, there may not be sufficient resin and other components of the treatment mixture left in the garment to obtain the desired characteristics. On the other hand, if the garments are not dried to the target moisture level, they may contain too much of the components in the mixture with the result that the garments will not have sufficient durability.

The amount of time required to reach the target moisture level will depend on the weight of the fabric, the temperature of the dryer, the duration of the drying cycle, and the extent to which the garments are tumbled. However, it is important to keep the drying temperature below a temperature which will cause the resin to set. Therefore, for the resins used in the foregoing examples, the drying temperature should be kept below approximately 150° F.

Once the garments have been dried to the proper moisture level, they are ready for the pressing and final cure steps. It is important to press and finally cure the garments without substantial delay, i.e. delay of more than approximately 12 to 24 hours, depending upon the weight of the fabric comprising the garments. Denim fabrics can be held between the drying and the pressing steps longer than lighter weight fabrics, because they tend to more readily retain moisture. Pressing of the garments in accordance with the present invention is done with a garment press capable of exerting a vacuum on the garment through the lower plate of the press. Initially, the garments are positioned with the aid of a vacuum to eliminate wrinkles and they are subsequently subjected to a steam treatment for approximately five seconds with the vacuum turned off. Steam is then applied to the garment through the top plate of the press for approximately 5 seconds. The steam is applied in combination with light clamping pressure in the amount of approximately 40 lbs. (178 newtons) After the steam is stopped, full pressure and heat are applied to the garment with the upper plate of the press. The full pressure and heat are applied so as to bring the temperature of the garment to about 290° F. The full clamping pressure during the final phase of the pressing cycle should be about 60 lbs. (267 newtons) to 70 lbs. (311 newtons), and should be held for approximately 5 seconds. After the full pressure and heat are applied, a brief (approximately 3 seconds) vacuum is applied to the garment in order to begin to control the amount of vapors to which the press operator is exposed and to cool the garment. After the garments have been pressed, they are hung on racks in

6,102,973

7

such as way as to provide space of about 6 inches between each garment. The garment is then baked in ovens for approximately 15 minutes at a temperature of between approximately 290° F. to 320° F.

After the garments have been subjected to the baking cycle, they are allowed to cool and are then ready for shipment. While the foregoing process is particularly well suited for garments made of fabric containing at least some cotton, the process is applicable to garments containing synthetic fabrics alone.

Garments treated in accordance with the processes described above have excellent hand and exhibit substantial durable press characteristics.

It should be noted that none of the formulations described above with respect to the examples contain acetic acid. Requiring that the fabrics have a fabric pH of between 6 and 7 prior to their treatment in accordance with the present invention eliminates the need to add acetic acid to the treatment mix. Depending on the alkalinity or the acidity of the denim used to make some garments, the prewashing treatment of the fabrics may require the addition of acetic acid to either raise the pH or the addition of soda ash to lower the pH. However, in accordance with the present invention, this is done in a pre-wash process and not in connection with the durable press treatment cycle, and may not be required at all.

In connection with the pressing cycle, it has been found that the separate application of steam prior to the application of full heat and pressure provides a particularly effective durable press finish on the garment.

While specific embodiments of the invention have been shown and described, it will be apparent to those skilled in the art that numerous alternatives, modifications, and variations of the embodiment shown can be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. A method of treating a garment to impart durable press characteristics comprising:

starting with a garment in which the fabric of the garment has a pH of between about 6 and about 7,

preparing a mixture in a garment washing machine, said mixture comprising the following components at the following percentages of the total weight of said mixture, approximately 0.1% of a wetting agent, approximately 7.0% to approximately 9.0% of a glycolated dimethylol dihydroxyethylene urea, approximately 3.0% of an aqueous emulsion of high density polyethylene, and between approximately 1.5% and approximately 6.0% of an aqueous emulsion containing a silicone based polymer, and between approximately 81.9% and approximately 88.4% water,

agitating the mixture for approximately 3 to approximately 4 minutes,

placing said garment in said machine and submerging said garment in said mixture for approximately 10 minutes, extracting the mixture from said garment so that said garment has a wet pickup of between approximately 70% and approximately 80%, based on the dry weight of said garment,

drying said garment to a moisture level, as a percentage of maximum moisture content, of between approximately 11% to approximately 15%,

subjecting said garment to a pressing cycle not more than approximately 24 hours after said garment has been dried, and

8

baking said garment in an oven for approximately 15 minutes at a temperature of between approximately 290° F. and 320° F.,

wherein said aqueous emulsion containing a silicone based polymer is selected from the group consisting of an aqueous emulsion of silicone fluid made with non-ionic emulsifiers and an aqueous emulsion containing a cationic aminofunctional polysiloxane.

2. A method in accordance with claim 1 wherein:

said garment is white and said aqueous emulsion containing a silicon based polymer is an aqueous emulsion containing silicon fluid with non-ionic emulsifiers.

3. A method in accordance with claim 1 wherein:

said garment is dyed and said aqueous emulsion containing a silicon based polymer is an aqueous emulsion with a cationic aminofunctional polysiloxane.

4. A method in accordance with claim 1 wherein:

said pressing cycle comprises the steps of:

arranging said garment on the lower plate of a garment press with the aid of a vacuum applied to the garment through said lower plate,

turning said vacuum off,

applying steam to said garment through the upper plate of said press while applying pressure of not more than about 178 Newtons of clamping force to said garment with said upper and lower plates of said garment press,

turning said steam off,

increasing said clamping force to at least about 267 Newtons for about 5 seconds while said upper plate of said press is heated so as to raise the temperature of said garment to at least about 290° F.

5. A method in accordance with claim 1 wherein:

said garment is non-white and a defoamer comprised of paraffinic oils and alkoxylated surfactants is added to said mixture prior to the placement of said garment in said mixture, said defoamer being added in an amount equal to approximately 0.1% by weight of said mixture.

6. A method in accordance with claim 2 wherein:

the garment and said mixture are agitated together for said approximately 10 minutes.

7. A method in accordance with claim 1 wherein:

said garment is non-white and a dye fixer comprised of an aqueous solution of cationic polymers with non-ionic emulsifiers is added to said mixture prior to the placement of said garment in said mixture.

8. A method in accordance with claim 7 wherein:

the amount of said dye fixer is approximately 1.5% by weight of said mixture.

9. A method of treating a garment to impart durable press characteristics comprising:

starting with a garment in which the fabric of the garment has a pH of between about 6 and about 7,

preparing a mixture comprising the following components at the following percentages of the total weight of said mixture, approximately 0.1% of a wetting agent, approximately 7.0% to approximately 9.0% of a glycolated dimethylol dihydroxyethylene urea, approximately 3.0% of an aqueous emulsion of high density polyethylene, and between approximately 1.5% and approximately 6.0% of an aqueous emulsion containing a silicone based polymer, and between approximately 81.9% and approximately 88.4% water,

agitating the mixture for approximately 3 to approximately 4 minutes,

6,102,973

9

applying said mixture to said garment, and allowing said mixture to penetrate said garment for at least approximately 10 minutes,

drying said garment to a moisture level, as a percentage of maximum moisture content, of between approximately 11% to approximately 15%,⁵

subjecting said garment to a pressing cycle not more than approximately 24 hours after said garment has been dried, and

baking said garment in an oven for approximately 15¹⁰ minutes at a temperature of between approximately 290° F. and 320° F.,

wherein said aqueous emulsion containing a silicone based polymer is selected from the group consisting of an aqueous emulsion of silicone fluid made with non-ionic emulsifiers and an aqueous emulsion containing a cationic aminofunctional polysiloxane.¹⁵

10. A method in accordance with claim 9 wherein:

said garment is white and said aqueous emulsion containing a silicon based polymer is an aqueous emulsion²⁰ containing silicon fluid with non-ionic emulsifiers.

10

11. A method in accordance with claim 9 wherein: said garment is dyed and said aqueous emulsion containing a silicon based polymer is an aqueous emulsion with a cationic aminofunctional polysiloxane.

12. A method in accordance with claim 9 wherein: said pressing cycle comprises the steps of:

arranging said garment on the lower plate of a garment press with the aid of a vacuum applied to the garment through said lower plate,

turning said vacuum off,

applying steam to said garment through the upper plate of said press while applying pressure of not more than about 178 Newtons of clamping force to said garment with said upper and lower plates of said garment press,

turning said steam off,

increasing said clamping force to at least about 267 Newtons for about 5 seconds while said upper plate of said press is heated so as to raise the temperature of said garment to at least about 290° F.

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