



(11) **EP 1 859 016 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
16.05.2012 Bulletin 2012/20

(51) Int Cl.:
C11D 1/62 ^(2006.01) **C11D 3/00** ^(2006.01)

(21) Application number: **06723210.8**

(86) International application number:
PCT/EP2006/001971

(22) Date of filing: **28.02.2006**

(87) International publication number:
WO 2006/097207 (21.09.2006 Gazette 2006/38)

(54) **FABRIC CARE COMPOSITIONS**

GEWEBEPFLEGEZUSAMMENSETZUNGEN

COMPOSITIONS D'ENTRETIEN POUR TISSUS

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**

(30) Priority: **18.03.2005 GB 0505619**

(43) Date of publication of application:
28.11.2007 Bulletin 2007/48

(73) Proprietors:

- **Unilever PLC**
London
EC4Y 0DY (GB)

Designated Contracting States:
CY GB IE

- **Unilever N.V.**
3013 AL Rotterdam (NL)

Designated Contracting States:
**AT BE BG CH CZ DE DK EE ES FI FR GR HU IS IT
LI LT LU LV MC NL PL PT RO SE SI SK TR**

(72) Inventors:

- **DONEVA, Teodora A.,**
Unilever R & D Port Sunlight
Wirral,
Merseyside CH63 3JW (GB)

- **GRIFFITHS, Llyr G.,**
Unilever R & D Port Sunlight
Wirral,
Merseyside CH63 3JW (GB)
- **MOHAMMADI, Mansur S.,**
Unilever R & D Port Sunlight
Wirral,
Merseyside CH63 3JW (GB)
- **ORMANDY, Kevin A.,**
Unilever R & D Port Sunlight
Wirral,
Merseyside CH63 3JW (GB)
- **SOUTHEY-DAVIS, H.M.,**
Unilever R & D Port Sunlight
Wirral,
Merseyside CH63 3JW (GB)

(74) Representative: **Elliott, Peter William**
Unilever Patent Group
Colworth House
Sharnbrook
Bedford
MK44 1LQ (GB)

(56) References cited:

EP-A- 1 371 718	WO-A-01/45666
DE-A1- 10 248 583	US-A- 5 174 912
US-A1- 2002 065 208	US-A1- 2004 152 617

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 1 859 016 B1

Description

Field of the Invention

5 **[0001]** The present invention relates to fabric care compositions. More specifically, the invention relates to rinse cycle fabric care compositions which reduce the wrinkling of fabrics and in particular the dry or in-wear wrinkling giving fabrics an all-day-ironed look.

Background of the Invention

10 **[0002]** Fabric care compositions which reduce the wrinkling of fabrics being worn are known.
[0003] Mechanical wrinkle reduction techniques, such as heat and pressure, for example, ironing are effective ways of flattening garments. However the effect is not permanent and wrinkles reappear due to a range of shear, torsion and compressive deformation forces applied in wear. The body's heat and humidity work on the fabric to relax it and hence
15 to enhance the wrinkling of these deformational forces.

[0004] The prior art anti-wrinkle teaching can be rationalised into three approaches;

- (a) using lubricants to improve recovery from crease,
- (b) using cross-linkers and film formers to stiffen the fibres to resist creases in the first place, and
- 20 (c) combining (a) and (b).

[0005] The lubricants used in the prior art include silicones eg PDMS, aminosilicones, modified silicones, silicone copolymers, softeners (e.g. quaternary ammonium compounds) and other lubricants such as clays, waxes, polyolefins, synthetic and natural oils.

25 **[0006]** Film formers and cross-linkers used in the prior art include:

Natural Polymers - enzymes proteins, cyclodextrins, polysaccharides e.g. starch, chitin, chitosan, cellulose, 3-1,4-polysaccharides, SCMC, guar gum, HEC etc.,

30 Synthetic Polymers - polyamides, polyurethanes, polyamines, polyolefins, polyols, PEGs, polystyrene, PVA, PVC, vinyl polymers, acrylics,

Film forming polymers - copolymers, adhesives,

35 Reactive polymers - epichlorohydrin containing, isocyanate containing, epoxy containing Curable,

Elastomeric polymers - thermoplastic silicone elastomers,

Small Molecules - Salts, amino acids, sugars, saccharides, oligosaccharides, alcohols, acids, and

40 Crosslinkers - methylol urea based, carboxylic acid, formaldehyde, ammonia, triazine, epoxide.

[0007] WO 2004/018762A1 (Philips) discloses on wrinkle benefit using fusible elastomer film formers with cross-linked particles to improve recovery from wrinkle in spray or iron cartridge applications

45 **[0008]** WO 2004/048677 (Philips) discloses film formers for recovery in spray or iron cartridge applications including fusible elastomers + polycation salt for x-linking of elastomer.

[0009] WO 2001/25381-5 (Ciba) disclose compositions with (A) a fabric softener, (B) an additive and (C) selected polyorganosilicones to endow fabrics in domestic applications with anti-pilling, elasticity, hydrophilicity, drape, and wrinkle recovery respectively. These properties are endowed by the organosilicone. Amongst the additives polysilicic acid is
50 mentioned.

[0010] WO 2002/088293 and US-A1-2002/019236 (Unilever) both disclose fabric care compositions comprising coated particles comprising a solid core with a $D_{3,2}$ average particle size of between 10 to 700 nm in diameter and a coating of silicone polymer covalently bonded to the solid core. Silica is mentioned in a list of suitable solid core materials.

[0011] EP 1201817 (A1) (Procter & Gamble) discloses aminosilicones with sterically hindered functional groups for
55 in-wear wrinkle resistance, which are preferably delivered from a spray during domestic ironing process.

[0012] EP 1096060 (A1) (Procter & Gamble) discloses water-soluble silicone lubricants in combination with various polymeric compounds (film formers) which are said to provide fabrics with a wrinkle recovery angle of at least +15 units over and above water.

[0013] EP 953675 (A2,A3) (Dow Corning) a textile fabric coated with an elastomeric silicone-based compound with a reinforcing filler preferably a silica + a second laminar filler preferably talc and mica. The coated fabrics amongst other benefit have less friction and are used for car seat belts. No teaching exists on the wrinkle benefit of the mixed silicone + particulate fillers. GB 842027 (Monsanto Chemicals) discloses textile friction enhancing compositions based on silica nanoparticles dispersed inside an oil emulsion droplets. The oil can be any of the known textile oils including mineral or vegetable oils. The oil to silica ratio exceeds 6 and deposition levels of 3-7% oil and 0.1-0.5% of silica per weight of fabric are preferred.

[0014] US 2635056 (Monsanto) discloses treating textiles and fabrics with an aquasol of silica plus a polyhydric alcohol such as glycerol. The blends are termed alco-aquasols and provide exceptional slip resistance to textiles and surprisingly good handle and fabric feel attributed to the presence of glycerol. The silica to glycerol ratio used in the example is 1.4. It is stated that polyhydric alcohol level should not exceed twice that of silica.

[0015] WO-2001/083875 (Ajinomoto Co.) discloses the application of silica and a softener with a cationic acrylic binder followed by application of a treatment solution containing arginine to nylon tights so as to provide skin care benefits when the tights are worn.

[0016] EP 1024119 (A2,A3) (Relats) discloses textile articles made of SiO₂-containing fibres and procedure for improving their thermal stability.

[0017] JP 04255767 (Nichihan Kenkyusho K.K.) discloses coating compositions for textiles comprising a synthetic emulsion (acrylic), colloidal or microparticle metal oxide silica gel and a zeolite to provide textile coatings with good antibacterial, deodorising, drying and heat retention properties.

[0018] NL 8900473 (Hesco Fashion Netherlands) discloses the manufacture of viscose rayon-polyester coated with a mixture of a nonionic fatty acid condensates fabric softener and a blocking agent (blocking free movement of warp and weft - friction enhancer) acidic silica dispersion. The ratio of the softener to silica is 1:1 and the level applied 1% of silica and 1% of softener.

[0019] EP 0474207, US 2881146, US 3077460 and US 5102930 all disclose fabric treatment compositions comprising silica, an organopolysiloxane and a catalyst/curing agent to cause a polymer film to form on the fabrics.

[0020] There is no product available on the market that meets consumers need for an effective in-wear wrinkle resistance from the main wash or from the rinse.

[0021] Therefore, there is a need for an effective and efficient means for preventing wrinkles from reappearing after the ironing process in wear whilst the fabrics maintains a good handle, softness and comfort in wear.

[0022] It is desirable for consumers to have a composition for use in the rinse which provides effective elimination or reduction of wrinkles in dry fabric in wear in addition to the benefits of good softness and perfume normally expected from rinse added products.

[0023] In addition, it is particularly desirable that the in-wear wrinkle resistance is provided by the composition after the first wash cycle in which it is used.

Objects of the Invention

[0024] The present invention seeks to address one or more of the above-mentioned problems.

Summary of the Invention

[0025] According to one aspect of the present invention there is provided a fabric treatment composition for use in the rinse cycle of a washing machine for reducing in-wear wrinkle in fabrics, the composition comprising:

- a) a nanoparticle dispersion comprising particles having an average particle size in the range 5 to 500nm,
- b) a lubricant phase selected from a cationic fabric softener, a silicone oil, sucrose polyester oil and mixtures thereof, and
- c) water

in which the weight ratio of a) : b) is in the range 3 : 1 to 1 : 3, and in which the nanoparticle dispersion is a cationic, or neutral colloidal dispersion of silica.

[0026] The compositions of the invention are used in the rinse cycle of a laundry process and impart in-wear crease resistance to the treated fabrics. The compositions comprise a blend of nanoparticles, which act as a friction element, and a lubricant phase. The balance of the nanoparticles and lubricant phase provides the desired properties by virtue of their physical properties. The compositions of the invention are free from catalysts and curing agents and do not react to form a film when deposited on the fabric.

Detailed Description of the invention

[0027] The compositions of the present invention are typically for use as part of a fabric care composition which is delivered to the rinse cycle of an automatic washing machine.

Nanoparticles

[0028] The compositions of the present invention comprise a nanoparticle dispersion which act as a frictional element when deposited on the fabrics. The particles are inorganic.

[0029] Suitable inorganic nano-particles include silicas, SiO_2 .

[0030] The widely commercial and preferred inorganic nanoparticle are amorphous silicas available in the sol or colloidal form as defined on page 330 of The Chemistry of Silica, by R K Iler, Wiley-Interscience, New York, 1979.

[0031] Silica nanoparticles could also be of non-siliceous core as long as the surface of the nanoparticle is coated with silica as described on page 330 of Iler's book. The core can be of organic polymeric nature.

[0032] In the context of the present invention, "nanoparticle" denotes particles having an average particle size ranging from 5 to 500 nm. Larger particle size silica also aid crease resistance but apparently they are not as effective as those between 15-100 nm. Preferably all of the particles have a particle size below 500 nm, more preferably below 100 nm.

[0033] It has been found that a particle size of 500 nm or less provides excellent crease resistance on poplin fibres and a particle size of 300 nm or less provides excellent crease resistance on cotton fibres.

[0034] Dispersions having an average particle size in the range 10 to 50 nm are particularly useful. The amount to deposit between 0.25 to 2% and preferably between 0.25 to 0.5 wt% owf (0.0025 to 0.005 g/g of fabric).

[0035] Nanoparticles depending on their structure can provide additional benefits - aid odour absorption during the wear, increase longer lasting freshness, reduced glare and shine on ironing items, resistance to staining, and ease of stain removal in following washes can be achieved.

[0036] Preferred nanoparticles for use in the invention are colloidal silica. The term 'colloidal silica' here refers to dispersions or sols of discrete particles of amorphous silica, which are preferably stable. Reacted silica is the hydrophobic fumed silica as used in anti-foaming emulsions mentioned above.

[0037] Commercial colloidal silica is available containing up to 50% silica with particle diameter between 10-21 nm under the trade name Ludox (ex Grace Davison) and Snowtex (ex Nissan). Particular examples include Ludox CI (a cationic silica) and Ludox HS50 (an anionic silica), both having a particle size of 20 nm. The quoted size represents the linear diameter of the particle.

[0038] It is well known in the art that the surface of silica particles can be easily modified to endow them with additional benefits. For example modification with aluminates allows surface charge modification (positive charge). Silicas can be modified organically (organosols as described on page 412 of the above reference). The preferred silicas have suitable modification for surface charge and/or other textile functional benefits including antimicrobial, dermal and transdermal, controlled release of fragrance and repellent agents, improved abrasion stability, water and oil, dirt repellency, and UV protection as described in Journal of Sol-Gel Science and Technology 27, 43-52, 2003 by B Mahltig and H Bottcher; Modified Silica Sol coatings for Water-Repellent Textiles.

Lubricant phase

[0039] The compositions of the present invention comprise a fibre lubricant selected from silicone oils, sucrose polyester oils or oily sugar derivatives and quaternary ammonium fabric softening materials.

[0040] The lubricant phase of interest include silicone oils and oily sugar derivatives.

[0041] The silicone lubricants of interest include the classical three classes of non-reactive silicone polymers (PDMS), reactive silicone polymers (silanol terminated PDMS) and modified silicone polymers (amino/amide functional siloxanes, non-ionic modified siloxanes or polyether modified siloxanes). Preferred silicones are PDMS types in emulsion or microemulsion format, which are commercially available, for example, Dow Corning 1716 (cationic) microemulsion, etc. Also DC amino silicones 2-8669 nonionic microemulsion, 2-8203 nonionic microemulsion, 28197 nonionic macroemulsion.

[0042] Another class of preferred silicones are those ex Wacker including Wetsoft CTA (amino glycol PDMS), Finish CT 34E (amino PDMS emulsion), Finish CT 208E (amino OH PDMS emulsion), Finish CT 96 E (amino PDMS emulsion), and their Fluid L range, Fluid L 652 for example (amino PDMS).

[0043] Although silicone oils are preferred to improve the fabric handle and softness non-silicone lubricants such as sucrose polyester oils can provide the lubrication needed for fabric recovery from wrinkle. WO2002/019236A1 (Unilever) provides a fuller list of silicone polymers of interest and EP1205538 (Unilever) the class of drying oils.

[0044] A preferred class of commercial materials in which the particulate phase and a lubricant phase are combined include but not limited to Dow Corning's silicone + reacted silica blends marketed as anti-foaming agents including DOW

CORNING® Antifoam B, DOW CORNING® 544, DOW CORNING® Q2-3302 ANTIFOAM COMPOUND, DOW CORNING® 1581 WATER REPELLENT, DOW CORNING® 2-1912 FLUID.

[0045] Another preferred class of materials in which the particulate phase and the lubricant phase are combined include but not limited to Dow Corning MQ silicone resin range which contains a PDMS silicone oil and a silicone resin nano-particulate phase.

[0046] Suitable sucrose polyester oils are the reaction products of fatty acid methyl ester (FAME) of natural oils and sucrose. Suitable oils and their preparation are described in EP323670B1, EP 383404B1, WO 2001/46210, WO 98/16538, WO 01/46359A1 and British Patent Application No. 0501006.1.

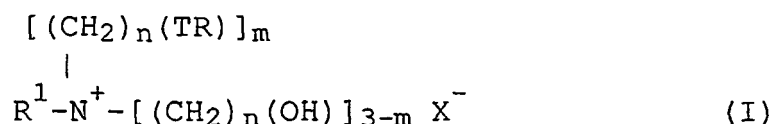
[0047] Preferred oils are derived from natural oils predominantly comprising C₁₆ and C₁₈ hydrocarbon chains e.g. palm kernel oil, soy bean oil.

[0048] The quaternary ammonium fabric softening material is generally one that is able to form a lamellar phase dispersion in water, in particular a dispersion of liposomes.

[0049] The quaternary ammonium compound "QAC" is preferably one having two C₁₂₋₂₈ groups, that may independently be alkyl or alkenyl groups, connected to the nitrogen head group, preferably being connected to the nitrogen head group by at least one ester link, and more preferably by two ester links.

[0050] The average chain length of the alkyl and/or alkenyl groups is preferably at least C₁₄ and more preferably at least C₁₆. It is particularly preferred that at least half of the groups have a chain length of C₁₈. In general, the alkyl and/or alkenyl groups are predominantly linear.

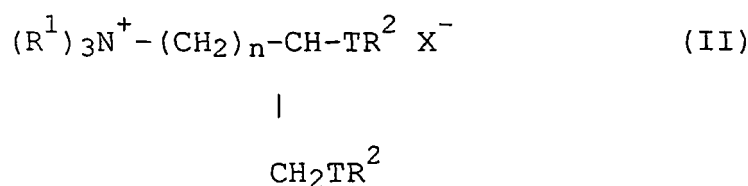
[0051] A first group of QACs suitable for use in the composition is represented by formula (I):



wherein each R is independently selected from a C₅₋₃₅ alkyl or alkenyl group; R¹ represents a C₁₋₄ alkyl, C₂₋₄ alkenyl or a C₁₋₄ hydroxyalkyl group; T is generally O-CO. (i.e. an ester group bound to R via its carbon atom), but may alternatively be CO-O (i.e. an ester group bound to R via its oxygen atom); n is a number selected from 1 to 4; m is a number selected from 1, 2, or 3; and X⁻ is an anionic counter-ion, such as a halide or alkyl sulphate, e.g. chloride or methylsulphate. Di-esters variants of formula I (i.e. m = 2) are preferred and typically have mono- and tri-ester analogues associated with them. Such materials are particularly suitable for use in the present invention.

[0052] Especially preferred agents are di-esters of triethanolammonium methylsulphate, otherwise referred to as "TEA ester quats". Commercial examples include Prapagen TQL, ex Clariant, and Tetranyl AHT-1, ex Kao, (both di-[hardened tallow ester] of triethanolammonium methylsulphate), AT-1 (di-[tallow ester] of triethanolammonium methylsulphate), and L5/90 (di-[palm ester] of triethanolammonium methylsulphate), both ex Kao, and Rewoquat WE15 (a di-ester of triethanolammonium methylsulphate having fatty acyl residues deriving from C₁₀-C₂₀ and C₁₆-C₁₈ unsaturated fatty acids), ex Witco Corporation.

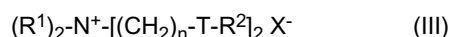
[0053] The second group of QACs suitable for use in the composition is represented by formula (II):



wherein each R¹ group is independently selected from C₁₋₄ alkyl, hydroxyalkyl or C₂₋₄ alkenyl groups; and wherein each R² group is independently selected from C₈₋₂₈ alkyl or alkenyl groups; and wherein n, T, and X⁻ are as defined above.

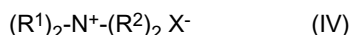
[0054] Preferred materials of this second group include 1,2 bis[tallowoyloxy]-3-trimethylammonium propane chloride, 1,2 bis[hardened tallowoyloxy]-3-trimethylammonium propane chloride, 1,2-bis[oleoyloxy]-3-trimethylammonium propane chloride, and 1,2 bis[stearoyloxy]-3-trimethylammonium propane chloride. Such materials are described in US 4,137,180 (Lever Brothers). Preferably, these materials also comprise an amount of the corresponding mono-ester.

[0055] A third group of QACs suitable for use in the composition is represented by formula (III):



wherein each R¹ group is independently selected from C₁₋₄ alkyl, or C₂₋₄ alkenyl groups; and wherein each R² group is independently selected from C₈₋₂₈ alkyl or alkenyl groups; and n, T, and X⁻ are as defined above. Preferred materials of this third group include bis(2-tallowoxyloxyethyl)dimethyl ammonium chloride and hardened versions thereof.

[0056] A fourth group of QACs suitable for use in the composition is represented by formula (IV):



wherein each R¹ group is independently selected from C₁₋₄ alkyl, or C₂₋₄ alkenyl groups; and wherein each R² group is independently selected from C₈₋₂₈ alkyl or alkenyl groups; and X⁻ is as defined above. Preferred materials of this fourth group include di(hardened tallow)dimethylammonium chloride.

[0057] The iodine value of the softening agent is preferably from 0 to 20, more preferably from 0 to 4, and most preferably from 0 to 2. Essentially saturated material, i.e. having an iodine value of from 0 to 1, is used in especially high performing compositions. At low iodine values, the softening performance is excellent and the composition has improved resistance to oxidation and associated odour problems upon storage.

[0058] Iodine value is defined as the number of grams of iodine absorbed per 100 g of test material. NMR spectroscopy is a suitable technique for determining the iodine value of the softening agents of the present invention, using the method described in Anal. Chem., 34, 1136 (1962) by Johnson and Shoolery and in EP 593,542 (Unilever, 1993).

[0059] The softening agent is usually present in the compositions of the invention at a level of 5% or greater by weight of the total composition.

[0060] References to levels of cationic softening agent in this specification are to the total level of cationic softening agent, including all cationic components of a complex raw material that could enter aqueous lamellar phase together. With a di-ester softening agent, it includes any associated mono-ester or tri-ester that may be present.

[0061] For ease of formulation, the amount of softening agent is generally 50% or less, particularly 40% or less, and especially 30% or less by weight of the total composition. Generally the softening agent is present in an amount of from 3 to 20% by weight of the composition.

Fatty complexing agent

[0062] The composition of the present invention may comprise a fatty complexing agent. Especially suitable fatty complexing agents include fatty alcohols and fatty acids. Of these, fatty alcohols are most preferred.

[0063] Preferred fatty acids include hardened tallow fatty acid (available under the tradename Pristerene, ex Uniqema).

[0064] Preferred fatty alcohols include hardened tallow alcohol (available under the tradenames Stenol and Hydrenol, ex Cognis and Laurex CS, ex Albright and Wilson) and behenyl alcohol, a C22 chain alcohol, available as Lanette 22 (ex Henkel).

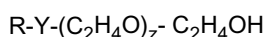
[0065] The fatty complexing agent is present in an amount of from 0.1% to 15% by weight based on the total weight of the composition. More preferably, the fatty component is present in an amount of from 0.2 to 10%, most preferably from 0.25 to 5%, e.g. 0.3 to 4% by weight.

Nonionic surfactant

[0066] The compositions further comprise a nonionic surfactant. Typically these can be included for the purpose of stabilising the compositions.

[0067] Suitable nonionic surfactants include addition products of ethylene oxide and/or propylene oxide with fatty alcohols, fatty acids and fatty amines.

[0068] Any of the alkoxylated materials of the particular type described hereinafter can be used as the nonionic surfactant. Suitable surfactants are substantially water soluble surfactants of the general formula:



where R is selected from the group consisting of primary, secondary and branched chain alkyl and/or acyl hydrocarbyl groups; primary, secondary and branched chain alkenyl hydrocarbyl groups; and primary, secondary and branched chain alkenyl-substituted phenolic hydrocarbyl groups; the hydrocarbyl groups having a chain length of from 8 to about 25, preferably 10 to 20, e.g. 14 to 18 carbon atoms.

[0069] In the general formula for the ethoxylated nonionic surfactant, Y is typically:



in which R has the meaning given above or can be hydrogen; and Z is at least about 8, preferably at least about 10 or 11.

[0070] Preferably the nonionic surfactant has an HLB of from about 7 to about 20, more preferably from 10 to 18, e.g. 12 to 16.

[0071] Examples of nonionic surfactants follow. In the examples, the integer defines the number of ethoxy (EO) groups in the molecule.

A. Straight-Chain, Primary Alcohol Alkoxylates

[0072] The deca-, undeca-, dodeca-, tetradeca-, and pentadeca-ethoxylates of n-hexadecanol, and n-octadecanol having an HLB within the range recited herein are useful viscosity/ dispersibility modifiers in the context of this invention.

Exemplary ethoxylated primary alcohols useful herein as the viscosity/dispersibility modifiers of the compositions are C₁₈ EO(10); and C₁₈ EO(11). The ethoxylates of mixed natural or synthetic alcohols in the "tallow" chain length range are also useful herein. Specific examples of such materials include tallow alcohol-EO(11), tallow alcohol-EO(18), and tallow alcohol-EO (25), coco alcohol-EO(10), coco alcohol-EO(15), coco alcohol-EO(20) and coco alcohol-EO(25).

B. Straight-Chain, Secondary Alcohol Alkoxylates

[0074] The deca-, undeca-, dodeca-, tetradeca-, pentadeca-, octadeca-, and nonadeca-ethoxylates of 3-hexadecanol, 2-octadecanol, 4-eicosanol, and 5-eicosanol having an HLB within the range recited herein are useful viscosity and/or dispersibility modifiers in the context of this invention. Exemplary ethoxylated secondary alcohols useful herein as the viscosity and/or dispersibility modifiers of the compositions are: C₁₆ EO(11); C₂₀ EO(11); and C₁₆ EO(14).

C. Branched Chain Alkoxylates

[0075] Branched chain primary and secondary alcohols which are available from the well-known "OXO" process can be ethoxylated and employed as the viscosity and/or dispersibility modifiers of compositions herein.

D. Polyol Based Surfactants

[0076] Suitable polyol based surfactants include sucrose esters such sucrose monooleates, alkyl polyglucosides such as stearyl monoglucosides and stearyl triglucoside and alkyl polyglycerols.

[0077] The nonionic surfactant is preferably present in an amount from 0.01 to 10%, more preferably 0.1 to 5%, most preferably 0.35 to 3.5%, e.g. 0.5 to 2% by weight, based on the total weight of the composition.

Co-active softeners

[0078] In rinse cycle fabric care compositions, co-active softeners may also be incorporated in an amount from 0.01 to 20% by weight, more preferably 0.05 to 10%, based on the total weight of the composition. Preferred co-active softeners include fatty esters, and fatty N-oxides.

[0079] Preferred fatty esters include fatty monoesters, such as glycerol monostearate. If GMS is present, then it is preferred that the level of GMS in the composition, is from 0.01 to 10 wt%, based on the total weight of the composition.

[0080] The co-active softener may also comprise an oily sugar derivative. Suitable oily sugar derivatives, their methods of manufacture and their preferred amounts are described in WO-A1-01/46361 on page 5 line 16 to page 11 line 20, the disclosure of which is incorporated herein.

Polymeric viscosity control agents

[0081] It is useful, though not essential, if the compositions comprise one or more polymeric viscosity control agents. Suitable polymeric viscosity control agents include nonionic and cationic polymers, such as hydrophobically modified cellulose ethers (e.g. Natrosol Plus, ex Hercules), cationically modified starches (e.g. Softgel BDA and Softgel BD, both ex Avebe). A particularly preferred viscosity control agent is a copolymer of methacrylate and cationic acrylamide available under the tradename Flosoft 200 (ex SNF Floerger).

[0082] Nonionic and/or cationic polymers are preferably present in an amount of 0.01 to 5wt%, more preferably 0.02 to 4wt%, based on the total weight of the composition.

Further Optional Ingredients

[0083] Other optional nonionic softeners, bactericides, soil-releases agents may also be incorporated in the rinse cycle fabric care compositions.

[0084] Such compositions may also contain one or more optional ingredients conventionally included in liquid rinse fabric conditioning compositions such as pH buffering agents, perfume carriers, fluorescers, colourants, hydrotropes, antifoaming agents, antiredeposition agents, polyelectrolytes, enzymes, optical brightening agents, anti-shrinking agents, anti-spotting agents, antioxidants, sunscreens, anti-corrosion agents, drape imparting agents, anti-static agents, ironing aids and dyes.

[0085] The lubricant and the particulate phases in the compositions of the invention can be in a fully dispersed state, partially flocculated or associated in the form of a Pickering emulsion where the particles stud the surface of the emulsion or liposome droplets to form a nanoparticle-droplet composite - *studded particles*.

Preparation

[0086] The composition may be prepared according to any suitable method. In one method the nanoparticle dispersion plus the lubricant emulsion or microemulsion if needed can be post dosed into the fabric softening base after it is manufactured with minimum agitation to prevent flocculation.

[0087] In another method of addition the nanoparticle phase at the required level can be post-dosed into an off-the-shelf ready fabric conditioner.

Product Form

[0088] The product preferably comprises a liquid, preferably an aqueous liquid.

Product Use

[0089] The composition can be a rinse cycle fabric care composition for use in a conventional automatic washing machine.

Summary of Drawings

[0090]

Figures 1a and 1b represent a standard Wrinkle Recovery Tester Instrument Model 155 commercially available from James H Heal & Co. Ltd.,

Figure 2 represents images of the existing AATCC 128 Scale,

Figure 3 represents images of the new U Scale and

Figure 4 is a plot showing the comparison of the AATCC scale with the new U Scale.

Evaluation of in-wear wrinkling

[0091] It has been discovered that the traditional Crease or Wrinkle Recovery Angle (CRA) approach for characterising anti-wrinkle compositions of inventions, that is AATCC66-1990 (see EP-A-1096060) is largely irrelevant to in-wear wrinkle assessment. In in-wear wrinkling the sharpness of the fold and deformation matters and this is not measured by CRA.

[0092] There are many textile industry standard methods (Association of American Textile Chemists and Colourists - AATCC) described for generating and measuring wrinkling on fabric.

[0093] The AATCC 128 Wrinkle Recovery Test is that most widely used to determine the wrinkle recovery of garments and is referenced widely in the external literature. A test fabric is wrinkled under standard conditions of load, time and environmental conditions using a standard Wrinkle Recovery Tester model 155 device supplied by James H Heal & Co Ltd (Figure 1). The level of wrinkled state is ranked visually with reference to a standard 3D (cast) replica scale, WR1-WR5, where WR1 = no recovery from creasing and WR5 = full recovery using a defined illumination set-up. Figure 2 shows this 3D AATCC 128 wrinkle scale.

[0094] However, the existing 3D AATCC 128 scale is not ideal when testing fabrics for in-wear wrinkling for the following reasons.

[0095] The existing AATCC 128 3D standards cannot allow a panellist to distinguish fine differences in intensity of wrinkling. For example in in-wear wrinkling the range of wrinkle falls around 2.5 to 3.5 but the 128 scale covers the broad brush scale of 1 to 5 missing details in the 2.5-3.5 range of interest.

[0096] Hence there is a need for a more relevant scale to assess the intensity of wrinkling with good discrimination.

[0097] The new scale, called **U scale** hereafter, emerged from images of woven cotton poplin monitors wrinkled, using the Wrinkle Recovery Tester model 155, to severity between 0 = not wrinkled (flat) and 10 = severely wrinkled as shown in Figure 3. This scale therefore covers a wider spectrum of wrinkles in the middle range allowing panellists to discriminate

fine details in a systematic manner.

[0098] Compared to AATCC128 scale, which manifests a rather flat insensitive region around a score of 3, the new U scale allows discrimination between the intensity of wrinkling around this region. Figure 4 shows the comparison between the two scales graphically.

Methodology

1. Monitor Preparation

[0099] The test solution is prepared with the desired strength or the desired % owf and stabilised overnight on a roller bank.

[0100] The monitor is then weighed (W1), soaked in the test solution and compressed between the rollers of the Werner Mathis AG padder so that it weighs double its original weight.

[0101] The monitor is left to dry at controlled temperature and RH (20°C/65%RH) for 24 hours and then re-weighed (W2).

[0102] The weight of additive on the monitor is (W2 - W1) from which the %owf can be calculated.

[0103] The dry monitor is ironed flat using the Philips Azur 4000 iron on the hottest setting and with highest steam setting and left to condition for a further 24 hours at controlled T and RH (20°C/65%RH).

[0104] Six such test monitors per treatment are prepared.

[0105] In each test there are control monitors for comparison with the composition treated monitors. These control monitors are treated with demineralised water instead of the compositions and prepared in the same way.

2. Wrinkling

[0106] To generate wrinkled state the monitors are loaded onto a Wrinkle Recovery Tester model 155 so that the warp direction is vertical. The fabric is then compressed (wrinkled) using no additional weight for 8 minutes.

[0107] After wrinkling the monitors are hung up for 24 hours at 20°C/65%RH.

3. Monitor Assessment

[0108] A digital photograph image is taken of each monitor using a Nokia Digital Camera under identical lighting conditions. The standard lighting conditions are achieved using a Verivide Crease Imaging Cabinet.

[0109] The images are then loaded into a panelling programme and each image is presented to the panellist to score against images of the scale being used - either AATCC128 or U Scale.

[0110] Six trained panellists score all monitors for wrinkle intensity against the scale.

[0111] In each test six untreated control monitors are also prepared and wrinkled in exactly the same way as the treated monitors as described above to enable comparison with the compositions.

[0112] The invention will now be illustrated by the following nonlimiting examples. Further modifications will be apparent to the person skilled in the art. Samples of the invention are represented by a number. Comparative samples are represented by a letter. All values are percentage by weight of the active ingredient unless stated otherwise.

Examples

[0113] The formulations in the following Table 1 were prepared by co-melting the quaternary ammonium fabric softening material, tallow alcohol, and nonionic, heating water and adding the co-melt to the water under stirring to form a homogeneous mixture, allowing the mixture to cool and then adding the dye/perfume and preservative at 40°C. The mixture was allowed to cool further and then the silica dispersion was post-dosed with stirring.

Table 1

Ingredient	Example 1	Example 2	Example A
Tetranyl AHT-1 (1)	14.94	6.035	14.94
Genapol C200 (2)	0.38	0.10	0.38
Hydronol D(3)	1.00	0.20	1.00
silica(4)	10.96	4.43	-
polymer (5)	-	0.030	-

EP 1 859 016 B1

(continued)

Ingredient	Example 1	Example 2	Example A
Dye/perfume/preservative	minor	minor	minor
water	to 100	to 100	to 100
(1) Tetranyl AHT-1 is a fully hardened tallow triethanolamine quaternary fabric softener supplied by KAO at 85% active level (2) Genapol C200 is a coco (C9-C11) 20EO nonionic (Clariant) (3) Hydrenol D (Cognis) is a fully hardened vegetable derived C16-C18 fatty alcohol. (4) C820 is a 11% silica dispersion in water (Ciba) with 22 nm size silica particles. The quantities in the table show the amount of silica. (5) Natrasol 331 a hydrophobically modified hydroxy ethyl cellulose.			

[0114] The formulation of Examples A and 1 were subject to wrinkle testing and compared to the application of the silica dispersion and water. The results are reported in Table 2.

Table 2. **AATCC128** wrinkle score after 24hrs for fabric conditioner formulation combined with silica sample C820 for 0.3% owf deposition. The **HIGHER** the score the less the monitors are wrinkled.

	Example A	Example 1	silica (C820)	Water
Quat : silica ratio	1:0	1.3:1	0:1	Control
Score	2.86	3.39	3.53	3.17

[0115] As the results in Table 2 show the fabric conditioner formulation treatment on its own (Example A) provides little or no in-wear wrinkle benefit as the comparison with water control demonstrate. However the combination of fabric conditioner with silica particles in accordance with the invention offers improved in-wear wrinkle benefit.

[0116] Silica on its own gives the flattest state corresponding to the least in-wear wrinkle. However the fabric handle is too harsh and abrasive with silica alone.

[0117] Table 3 characterises the fabric handle obtained using the formulations. A lower 2HG5 score means that there is a more elastic response when a shearing force is applied to the treated fabric. A lower G score means that a lower level of stiffness is experienced when a shearing force is applied.

Table 3 Kawabata shear hysteresis (2HG5) and shear rigidity (G) data.

% owf	Example A	Example 1	Silica (C820)	water control
0.3% (2HG5)	10.60	6.30	12.36	10.807
0.3% (G)	1.98	1.68	2.49	2.00

[0118] The results show the combined lubricant/silica (Example 1) provides the desirable fabric smoothness and softness.

[0119] The formulations reported in the following Table 4 were prepared by mixing a silica dispersion with off-the-shelf fabric conditioning compositions. The silica dispersions was Ludox SP532-10519 a 40% silicon dispersion with 50 nm particle size ex Grace Davison. The fabric conditioning compositions were:

(A) Vernal Blue sky fabric conditioner from Henkel containing 13.9% by weight of a softener based on a partially hardened triethanolamine quaternary ammonium compound

(B) Comfort Blue fabric conditioner from Unilever having a composition as Example A.

Table 4. Formulations and U scale wrinkle scores for fabric treated (padded) with mixtures of quat:silica (Ludox SP532-10519) at a 0.5% owf one hour and 24 hours after wrinkling. The **lower** the score the less fabric is wrinkled.

	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8	Example A
fabric conditioner	A	A	A	B	B	B	Control
quat:silica weight ratio	1:1	1:2	2:1	1:1	1:2	2:1	1:0
1hr	3.50	2.72	3.10	2.21	2.32	2.72	4.22
24hr	2.80	2.38	2.50	2.35	2.17	2.48	3.26

[0120] Test of the monitors by an expert panel showed their handle and softness acceptable. Ease of ironing of the quat:silica blends was comparable with to that of Comfort commercial fabric conditioner

[0121] Another class of lubricant-particle blends belong to the MQ silicone resin class from Dow Corning shown in Tables 5 and 6. The intensity of wrinkling is reduced compared to untreated after 1 hr and 24hrs at the preferred deposition levels.

Table 5. U scale wrinkle scores after 1 hr and 24hrs for o/w emulsion of silicone oil/silicone resin blends using cationic emulsifier.

Ratio PDMS/silicone resin blend (cationic emulsifier)								
%owf	40/60		30/70		20/80		Untreated	
	1hr score	24hr score	1hr score	24hr score	1hr score	24hr score	1hr score	24hr score
0.1	3.71	2.97	3.17	2.61	3.25	2.49	3.60	2.88
0.25	3.08	2.49	2.78	2.29	2.40	1.93	3.60	2.88

Table 6. U scale wrinkle scores after 1 hr and 24hrs for o/w emulsion of silicone oil/silicone resin blends using nonionic emulsifier.

Ratio PDMS/silicone resin blend (non-ionic emulsifier)								
% owf	40/60		30/70		20/80		Untreated	
	1hr score	24hr score	1hr score	24hr score	1hr score	24hr score	1hr score	24hr score
0.1	2.67	1.67	2.15	2.08	2.75	2.38	3.58	2.89
0.25	1.83	2.14	2.92	2.25	3.58	2.38	4.00	2.89

[0122] In Tables 5 and 6 the composition of the internal phase of the emulsions is the same. They differ in the type of surfactant used for emulsification.

[0123] Table 7 shows the composition of the oil and water phases of the emulsions. The PDMS/resin blends in D5 (a low molecular weight silicone oil solvent) are mixed with water and emulsifier (not shown in Table 7).

Table 7 : Composition of PDMS/resin blend in emulsions.

Ingredient	% in composition
Water	50
D5	25
PDMS / Resin blend	25

[0124] Siloxane resin consisting of monovalent trisiloxy (M) groups having formula $R_3SiO_{1/2}$ and tetravalent siloxy (Q) groups having formula $SiO_{4/2}$ and the polymer is amino functionalised PDMS with some degree of OH termination of viscosity 4000 mPa s.

[0125] Table 8 provides the droplet sizes of the resin blend emulsions used in Tables 8 and 9.

Table 8. Emulsion droplet Size of PDMS/silicone resin polymer blends.

PDMS/MQ blend ratio	Surfactant Type	PSD (nm)
40/60	Nonionic	139
30/70	Nonionic	129
20/80	Nonionic	161
40/60	Cationic	116
30/70	Cationic	154
20/80	Cationic	139

[0126] The silicon resin blend treated monitors showed better softness and handle compared to silica at equal add-on level. Their ease of ironing was also improved compared to the silica.

Claims

1. A fabric treatment composition for use in the rinse cycle of a washing machine for reducing in-wear wrinkle in fabrics, the composition comprising:

- a) a nanoparticle dispersion comprising particles having an average particle size in the range 5 to 500 nm,
- b) a lubricant phase selected from a cationic fabric softener, a silicone oil, sucrose polyester oil and mixtures thereof, and
- c) water

in which the weight ratio of a) : b) is in the range 3 : 1 to 1 : 3, and in which the nanoparticle dispersion is a cationic, or neutral colloidal dispersion of silica.

2. A fabric treatment composition as claimed in Claim 1 in which the weight ratio of a) : b) is in the range 2 : 1 to 1.5 : 1.

3. A fabric treatment composition as claimed in Claim 1 or Claim 2 in which all the particles of the nanoparticle dispersion have a particle size less than 500 nm.

4. A fabric treatment composition as claimed in any preceding claim in which all the particles of the nanoparticle dispersion have a particle size less than 100 nm.

5. A fabric treatment composition as claimed in any preceding claim in which the particles of the nanoparticle dispersion have an average particle size in the range 10 to 50nm.

6. A fabric treatment composition as claimed in any preceding claim in which the silicone oil comprises polydimethyl siloxane.

7. An aqueous fabric softening composition as claimed in any preceding claim in which the fabric softening compound is a quaternary ammonium compound.

8. An aqueous fabric softening composition as claimed in Claim 7 in which the fabric softening compound comprises a quaternary ammonium compound with ester linkages.

9. An aqueous fabric softening composition as claimed in Claim 8 in which the fabric softening compound comprises a tallow based triethanolamine ammonium compound.

10. An aqueous fabric softening composition as claimed in any preceding claim in which the sucrose polyester is derived from palm kernel oil or soy bean oil.

11. An aqueous fabric softening composition as claimed in any preceding claim in which the lubricant phase b) is present in an amount of from 0.5 to 20% by weight of the composition.
12. An aqueous fabric softening composition as claimed in any preceding claim which additionally comprises a fatty alcohol or fatty acid containing from 8 to 22 carbon atoms.
13. An aqueous fabric softening composition as claimed in Claim 12 which comprises from 0.3 to 2% by weight of a C₁₆-C₁₈ fatty alcohol.
14. An aqueous fabric softening composition as claimed in any preceding claim which additionally comprises from 0.01 to 10% by weight of a nonionic surfactant.
15. An aqueous fabric softening composition as claimed in Claim 14 in which the nonionic surfactant is an addition product of ethylene oxide and/or propylene oxide with a fatty alcohol, fatty acid or fatty amine.
16. A method of treating a fabric which comprises applying a composition as claimed in any preceding claim in an amount to deposit from 0.2 to 4 percent by weight of the total of the particulate phase and lubricant phase and thereafter drying the fabric.
17. A method as claimed in Claim 16 in which the composition is applied in an amount to deposit from 0.5 to 2 percent by weight of the total of the particulate phase and lubricant phase.
18. A method as claimed in Claim 16 or Claim 17 in which the composition is applied during the rinse cycle of a washing machine.
19. A method as claimed in any one of Claims 16 to 18 comprising the additional step of ironing the fabric.

Patentansprüche

1. Gewebebehandlungszusammensetzung zur Verwendung im Spülgang einer Waschmaschine zur Verringerung von Trageknittern bei Geweben, wobei die Zusammensetzung umfasst:
 - a) eine Nanopartikeldispersion, die Partikel umfasst, welche eine durchschnittliche Partikelgröße im Bereich von 5 bis 500 nm haben,
 - b) eine Schmiermittelphase, die aus einem kationischen Gewebeweichmacher, einem Silikonöl, einem Saccharosepolyesteröl und Gemischen davon ausgewählt ist, und
 - c) Wasser,in der das Gewichtsverhältnis von a) : b) im Bereich von 3:1 bis 1:3 ist und in der die Nanopartikeldispersion eine kationische oder neutrale kolloidale Dispersion von Siliciumdioxid ist.
2. Gewebebehandlungszusammensetzung, wie sie in Anspruch 1 beansprucht ist, in der das Gewichtsverhältnis von a) : b) im Bereich von 2:1 bis 1,5:1 ist.
3. Gewebebehandlungszusammensetzung, wie sie in Anspruch 1 oder 2 beansprucht ist, in der alle Partikel der Nanopartikeldispersion eine Partikelgröße von weniger als 500 nm haben.
4. Gewebebehandlungszusammensetzung, wie sie in einem vorangehenden Anspruch beansprucht ist, in der alle Partikel der Nanopartikeldispersion eine Partikelgröße von weniger als 100 nm haben.
5. Gewebebehandlungszusammensetzung, wie sie in einem vorangehenden Anspruch beansprucht ist, in der die Partikel der Nanopartikeldispersion eine durchschnittliche Partikelgröße im Bereich von 10 bis 50 nm haben.
6. Gewebebehandlungszusammensetzung, wie sie in einem vorangehenden Anspruch beansprucht ist, in der das Silikonöl Polydimethylsiloxan umfasst.
7. Wässrige Gewebe weichmachende Zusammensetzung, wie sie in einem vorangehenden Anspruch beansprucht

ist, wobei die Gewebe weichmachende Verbindung eine quaternäre Ammoniumverbindung ist.

8. Wässrige Gewebe weichmachende Zusammensetzung, wie sie in Anspruch 7 beansprucht ist, in der die Gewebe weichmachende Verbindung eine quaternäre Ammoniumverbindung mit Esterverknüpfungen umfasst.
9. Wässrige Gewebe weichmachende Zusammensetzung, wie sie in Anspruch 8 beansprucht ist, in der die Gewebe weichmachende Verbindung eine Triethanolammoniumverbindung auf Talgbasis umfasst.
10. Wässrige Gewebe weichmachende Zusammensetzung, wie sie in einem vorangehenden Anspruch beansprucht ist, in der der Saccharosepolyester von Palmkernöl oder Sojabohnenöl abgeleitet ist.
11. Wässrige Gewebe weichmachende Zusammensetzung, wie sie in einem vorangehenden Anspruch beansprucht ist, in der die Schmiermittelpase b) in einer Menge von 0,5 bis 20 Gew.-% der Zusammensetzung vorliegt.
12. Wässrige Gewebe weichmachende Zusammensetzung, wie sie in einem vorangehenden Anspruch beansprucht ist, die zusätzlich einen Fettalkohol oder eine Fettsäure, der/die 8 bis 22 Kohlenstoffatome enthält, umfasst.
13. Wässrige Gewebe weichmachende Zusammensetzung, wie sie in Anspruch 12 beansprucht ist, die 0,3 bis 2 Gew.-% eines C₁₆-C₁₈-Fettalkohols umfasst.
14. Wässrige Gewebe weichmachende Zusammensetzung, wie sie in einem vorangehenden Anspruch beansprucht ist, die zusätzlich 0,01 bis 10 Gew.-% eines nicht-ionischen Tensids umfasst.
15. Wässrige Gewebe weichmachende Zusammensetzung, wie sie in Anspruch 14 beansprucht ist, in der das nicht-ionische Tensid ein Additionsprodukt von Ethylenoxid und/oder Propylenoxid mit einem Fettalkohol, einer Fettsäure oder einem Fettamin ist.
16. Verfahren zum Behandeln eines Gewebes, das Anwenden einer Zusammensetzung, wie sie in einem vorangehenden Anspruch beansprucht ist, in einer Menge zum Abscheiden von 0,2 bis 4 Gew.-% der Gesamtmenge der partikulären Phase und der Schmiermittelpase und danach Trocknen des Gewebes umfasst.
17. Verfahren, wie es in Anspruch 16 beansprucht ist, in dem die Zusammensetzung in einer Menge zur Abscheidung von 0,5 bis 2 Gew.-% der Gesamtmenge der partikulären Phase und der Schmiermittelpase angewendet wird.
18. Verfahren, wie es in Anspruch 16 oder Anspruch 17 beansprucht ist, in dem die Zusammensetzung während des Spülgangs einer Waschmaschine angewendet wird.
19. Verfahren, wie es in einem der Ansprüche 16 bis 18 beansprucht ist, das den zusätzlichen Schritt des Bügelns des Gewebes umfasst.

Revendications

1. Composition de traitement du tissu destinée à une utilisation dans le cycle de rinçage d'une machine à laver pour réduire le froissement du tissu lorsqu'il est porté, la composition comprenant :
 - a) une dispersion de nanoparticules comprenant des particules ayant une taille moyenne de particules dans la plage de 5 à 500 nm,
 - b) une phase lubrifiante choisie parmi un adoucissant cationique du tissu, une huile de silicone, une huile de polyester de saccharose et les mélanges de ceux-ci, et
 - c) de l'eau,
 dans laquelle le rapport en poids de a) : b) est dans la plage de 3:1 à 1:3, et dans laquelle la dispersion de nanoparticules est une dispersion colloïdale cationique ou neutre de silice.
2. Composition de traitement du tissu selon la revendication 1, dans laquelle le rapport en poids de a) : b) est dans la plage de 2:1 à 1,5:1.

3. Composition de traitement du tissu selon la revendication 1 ou la revendication 2, dans laquelle toutes les particules de la dispersion de nanoparticules ont une taille de particules inférieure à 500 nm.
- 5 4. Composition de traitement du tissu selon l'une quelconque des revendications précédentes, dans laquelle toutes les particules de la dispersion de nanoparticules ont une taille de particules inférieure à 100 nm.
5. Composition de traitement du tissu selon l'une quelconque des revendications précédentes, dans laquelle les particules de la dispersion de nanoparticules ont une taille moyenne de particules dans la plage de 10 à 50 nm.
- 10 6. Composition de traitement du tissu selon l'une quelconque des revendications précédentes, dans laquelle l'huile de silicone comprend du polydiméthylsiloxane.
7. Composition aqueuse d'assouplissement du tissu selon l'une quelconque des revendications précédentes, dans laquelle le composé d'assouplissement du tissu est un composé d'ammonium quaternaire.
- 15 8. Composition aqueuse d'assouplissement du tissu selon la revendication 7, dans laquelle le composé d'assouplissement du tissu comprend un composé d'ammonium quaternaire ayant des liaisons ester.
- 20 9. Composition aqueuse d'assouplissement du tissu selon la revendication 8, dans laquelle le composé d'assouplissement du tissu comprend un composé de triéthanolamine-ammonium à base de suif.
10. Composition aqueuse d'assouplissement du tissu selon l'une quelconque des revendications précédentes, dans laquelle le polyester de saccharose est dérivé de l'huile de palmiste ou de l'huile de soja.
- 25 11. Composition aqueuse d'assouplissement du tissu selon l'une quelconque des revendications précédentes, dans laquelle la phase lubrifiante b) est présente dans une proportion de 0,5 à 20 % en poids de la composition.
12. Composition aqueuse d'assouplissement du tissu selon l'une quelconque des revendications précédentes, qui comprend de plus un alcool gras ou un acide gras contenant de 8 à 22 atomes de carbone.
- 30 13. Composition aqueuse d'assouplissement du tissu selon la revendication 12, qui comprend de 0,3 à 2 % en poids d'un alcool gras en C₁₆-C₁₈.
14. Composition aqueuse d'assouplissement du tissu selon l'une quelconque des revendications précédentes, qui comprend de plus de 0,01 à 10 % en poids d'un tensioactif non ionique.
- 35 15. Composition aqueuse d'assouplissement du tissu selon la revendication 14, dans laquelle le tensioactif non ionique est un produit d'addition d'oxyde d'éthylène et/ou d'oxyde de propylène avec un alcool gras, un acide gras ou une amine grasse.
- 40 16. Procédé de traitement d'un tissu, qui comprend l'application d'une composition selon l'une quelconque des revendications précédentes dans une quantité permettant de déposer de 0,2 à 4 pour cent en poids du total de la phase particulaire et de la phase lubrifiante et, par la suite, le séchage du tissu.
- 45 17. Procédé selon la revendication 16, dans lequel la composition est appliquée dans une quantité permettant de déposer de 0,5 à 2 pour cent en poids du total de la phase particulaire et de la phase lubrifiante.
18. Procédé selon la revendication 16 ou la revendication 17, dans lequel la composition est appliquée pendant le cycle de rinçage d'une machine à laver.
- 50 19. Procédé selon l'une quelconque des revendications 16 à 18, comprenant l'étape supplémentaire de repassage du tissu.

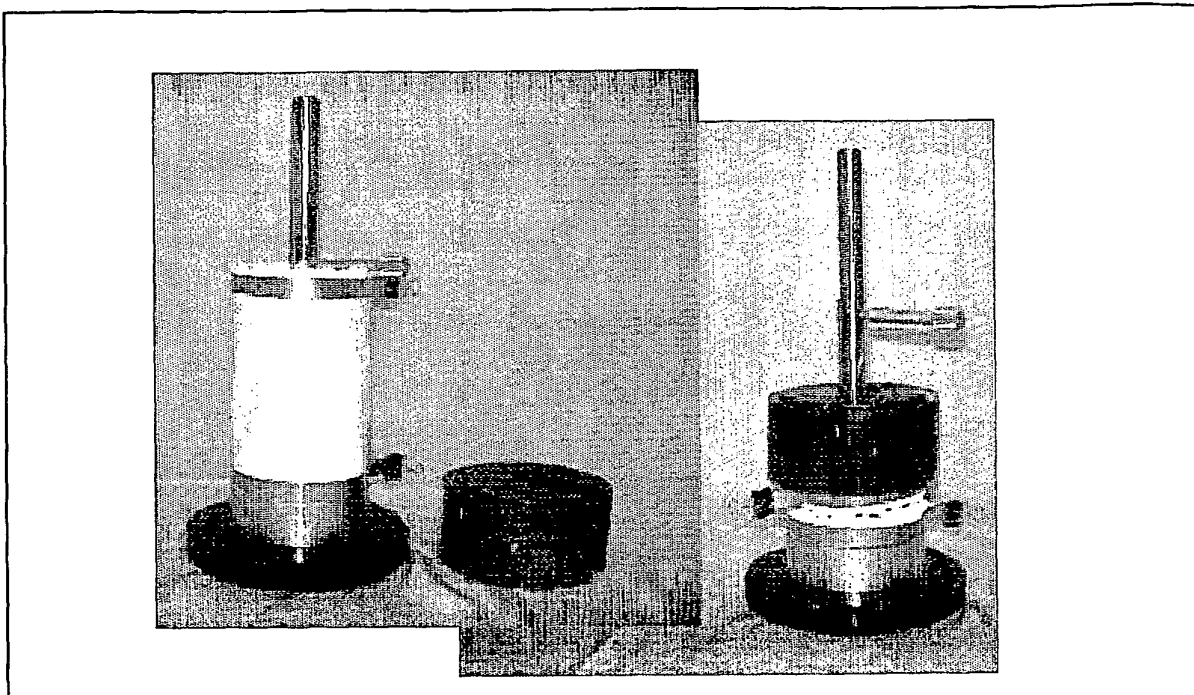


Figure 1a

Figure 1b

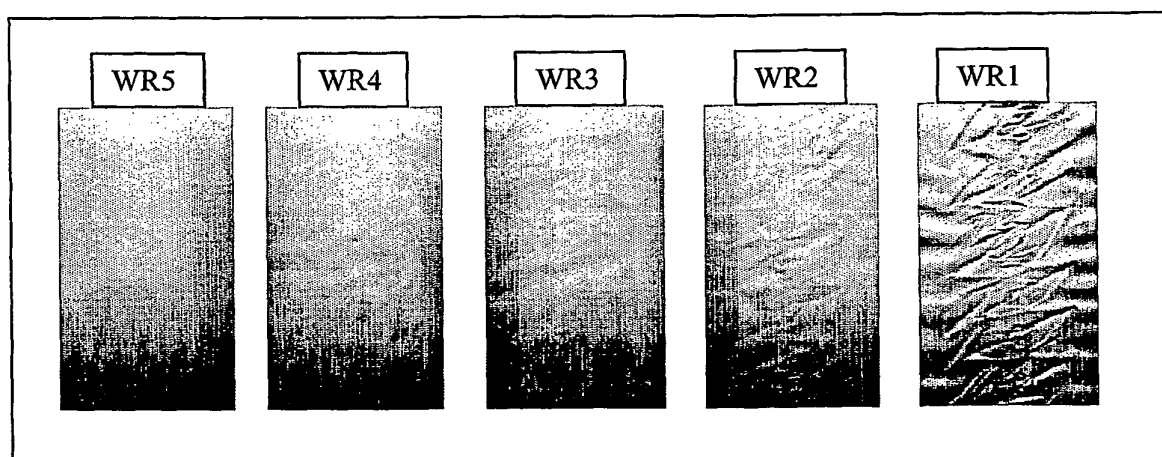


Figure 2.

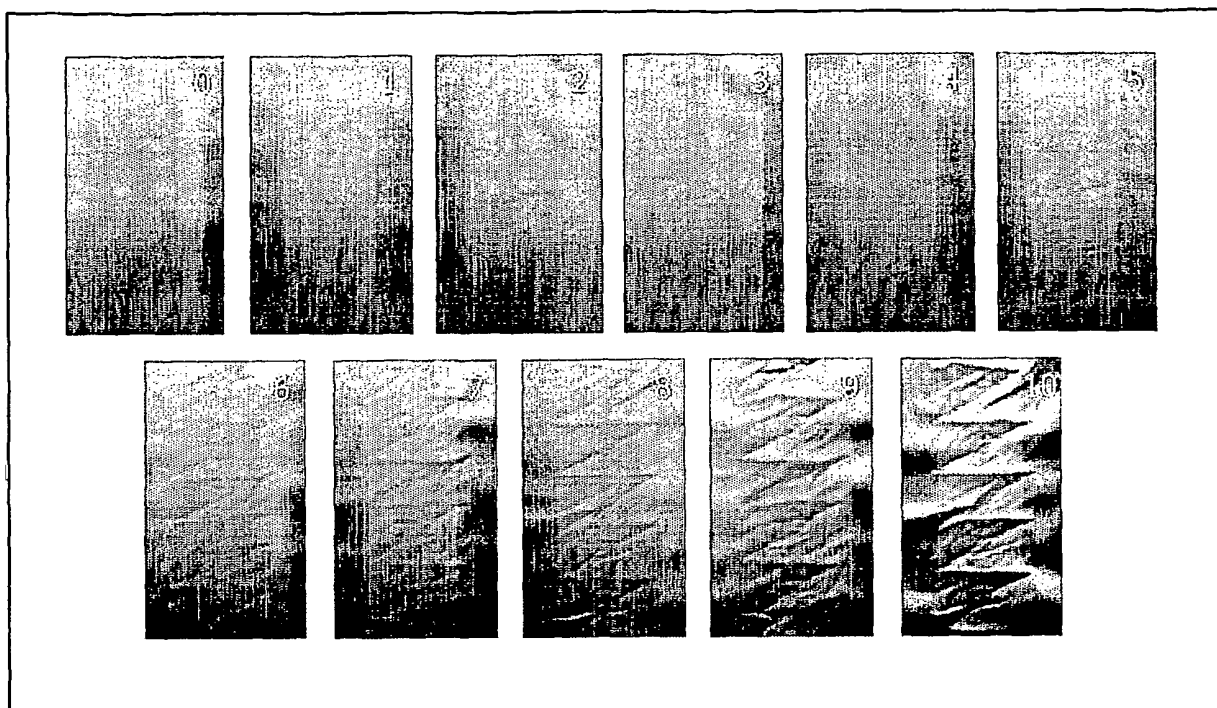


Figure 3.

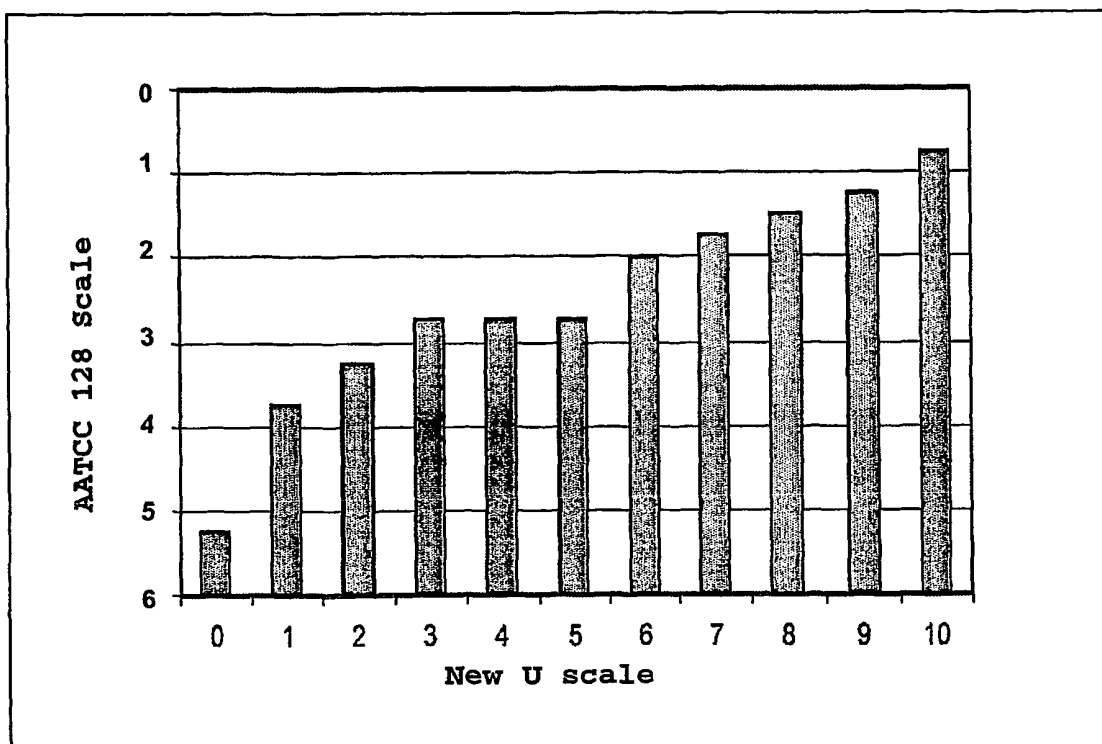


Figure 4.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2004018762 A1, Philips [0007]
- WO 2004048677 A, Philips [0008]
- WO 2001253815 A [0009]
- WO 2002088293 A [0010]
- US 2002019236 A1 [0010]
- EP 1201817 A, A1 [0011]
- EP 1096060 A, A1 [0012] [0091]
- EP 953675 A [0013]
- GB 842027 A [0013]
- US 2635056 A [0014]
- WO 2001083875 A [0015]
- EP 1024119 A [0016]
- JP 04255767 B [0017]
- NL 8900473 [0018]
- EP 0474207 A [0019]
- US 2881146 A [0019]
- US 3077460 A [0019]
- US 5102930 A [0019]
- WO 2002019236 A1 [0043]
- EP 1205538 A [0043]
- EP 323670 B1 [0046]
- EP 383404 B1 [0046]
- WO 200146210 A [0046]
- WO 9816538 A [0046]
- WO 0146359 A1 [0046]
- GB 0501006 A [0046]
- US 4137180 A [0054]
- EP 593542 A [0058]
- WO 0146361 A1 [0080]

Non-patent literature cited in the description

- **R K ILER.** The Chemistry of Silica. Wiley-Interscience, 1979, 330 [0030]
- **B MAHLTIG ; H BOTTCHEER.** Modified Silica Sol coatings for Water-Repellent Textiles. *Journal of Sol-Gel Science and Technology*, 2003, vol. 27, 43-52 [0038]
- **JOHNSON ; SHOOLERY.** *Anal. Chem.*, 1962, vol. 34, 1136 [0058]