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(54) **Improvements relating to domestic laundering**

(57) An aqueous textile treatment liquor suitable for use in a domestic laundering process comprising a detergent surfactant, positively charged, particulate material having a particle size of 5-200nm, and, an emulsified, water-dispersible silicone blend comprising both silicone

and at least one amino-silicone, the weight ratio of silicone to amino silicone being in the range 20:1 to 3:1 and said silicone blend having a droplet size of 5-20 microns.

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Description**Technical Field**

5 **[0001]** The present invention relates to treatment of textiles during a laundering process. In particular it is concerned with treatments that will soften fabrics and reduce the incidence of wrinkle formation during wear.

Background of the Invention

10 **[0002]** Physical wrinkle-reduction techniques, such as heat and pressure, (for example steam pressing/ironing) are long established and effective ways of flattening garments. However, the effect is not permanent and wrinkles reappear 'in wear' due to a range of shear, torsion and compressive deformation forces. The body's heat and humidity enhance the effect of these forces.

15 **[0003]** Chemical wrinkle-reduction techniques are also known. These 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).

[0004] A wide range of lubricants and cross linkers has been proposed. The lubricants used in the prior art include silicones such as polydimethyl siloxane (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 **[0005]** Film formers and cross-linkers suggested in the prior art include: natural polymers (such as enzymes proteins, cyclodextrins, polysaccharides e.g. starch, chitin, chitosan, cellulose, 3-1,4-polysaccharides, SCMC, guar gum, HEC etc.), and synthetic polymers (such as polyamides, polyurethanes, polyamines, polyolefins, polyols, PEGS, polystyrene, PVA, PVC, vinyl polymers, acrylics). Functionally, some of these have been described as film forming polymers, reactive polymers (such as epichlorohydrin containing, isocyanate containing, epoxy containing or curable materials), or, elastomeric polymers (including both thermoplastic elastomers and silicone elastomers).

30 **[0006]** Other attempts to avoid wrinkles have employed small molecules such as salts, amino acids, sugars, saccharides, oligosaccharides, alcohols and acids. Known crosslinkers also include methylol urea based, carboxylic acid, formaldehyde, ammonia, triazine, and epoxide compositions.

35 **[0007]** WO 2004/018762A1 (Philips) discloses use of fusible elastomer film formers with cross-linked particles to improve recovery from wrinkle in spray or iron cartridge applications

[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.

40 **[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 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.

45 **[0011]** EP-A-1201817 (Procter & Gamble) discloses aminosilicones with sterically hindered functional groups for in-wear wrinkle resistance, which are preferably delivered from a spray during domestic ironing process.

[0012] EP-A-1096060 (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.

50 **[0013]** EP-A-953675A2 (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.

55 **[0014]** 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.

[0015] It has been proposed to use so-called 'nanoparticles' for fabric treatment. WO 02/064877 (P&G) discloses

coating compositions, which comprise a 'nanoparticle' system of a size of less than or equal to 750nm, with a lower limit of '0' nm. Examples provided include synthetic silica (10-40nm), boehemite alumina (2-750nm) and 'nanotubes' (2-50nm). Clays, particularly plate-like laponites (25-40nm wide and ~1nm thick) are considered suitable and organic materials such as nano-latexes are proposed.

[0016] EP 1371718 (Rohm and Haas) discloses 1-10 nm polymeric nanoparticles as a fabric care additive. These can be organically modified with silicones.

[0017] WO 02/18451 (Rhodia) discloses the use of nanoparticles in a polymeric or nano-latex form.

[0018] DE 10248583 (Nanogate Technologies GmbH) discloses the use of inorganic nanoparticles as a carrier for a silane material.

[0019] Our earlier co-pending application PCT/EP2005/012863, unpublished at the filing date of this application discloses the use of negatively charged, hybrid organic/inorganic nanoparticles of 1-10nm, in a surfactant composition suitable for the treatment of cotton. It is believed that these particles penetrate into the pores of the cotton fibre and that this stiffens the fibre.

[0020] 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.

[0021] 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.

[0022] EP-A-1024119 (Relats) discloses textile articles made of SiO₂-containing fibres and procedure for improving their thermal stability.

[0023] 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.

[0024] 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.

[0025] Despite all this effort, no known product meets the consumer's need for an effective in-wear wrinkle resistance from a composition, which can be simply delivered in the main-wash whilst the fabrics maintain a good handle, softness and comfort in wear. Such a composition should not have adverse effects to the user due to the reactive nature of the chemistry involved. In addition it is particularly desirable that a product provides the in-wear wrinkle resistance after the very first wash cycle in which it is used.

[0026] Similar difficulties as regards main-wash delivery of softness are known. Attempts have been made to deliver softening agents from the main wash, but these have generally delivered a reduced level of softness due to the cleaning effects of the surfactants present or other interactions between the surfactants and the softeners.

Brief Description of the Invention

[0027] We have determined that a combination of relatively small positively charged particles and specific class of lubricant droplets can provide 'in wear' crease and wrinkle benefits delivered from the main wash. These compositions can also provide a softness benefit. This enables the formulation of a main-wash product which gives a so-called 'two-in-one' benefit and avoids the need for the use of a separate composition added in the rinse or used in after-wash treatment, such as during ironing. The composition avoids the use of reactive chemical species.

[0028] The present invention provides an aqueous textile treatment liquor suitable for use in a domestic laundering process comprising:

a) 0.1-10g/L of a deterative surfactant,

b) 0.001-1g/L positively charged, particulate material having a particle size of 5-200nm, and,

c) 0.001-1g/L of an emulsified, water-dispersible silicone blend comprising both silicone and at least one amino-silicone, the weight ratio of silicone to amino silicone being in the range 20:1 to 3:1 and said silicone blend having a droplet size of 5-20 microns.

[0029] While it is not intended to limit the invention by reference to any theory of operation, it is believed that the particulate material associates with the yarn/fibres of the textile so as to stiffen the yarn/fibres and therefore resist

wrinkling. At the same time, the silicone blend lubricates the yarn/fibres to assist with recovery from creasing and wrinkling while also ensuring that there is an even feel to the whole of the textile.

[0030] The particle/silicone blend also provides softness. In a particularly preferred embodiment of the invention this is a 'non-greasy' softness which does not have an 'oily' feel, and is described by panellists as a 'dry' softness.

[0031] Deterative surfactants are present in the composition to assist in cleaning. Typically, the deterative surfactant will comprise anionic surfactants, nonionic surfactants or a mixture thereof. In the case of the present invention, the anti-wrinkling effect and the softening effect are, surprisingly, not negated by the presence of the surfactant. Builders may also be present, as may other components generally present in laundering compositions.

[0032] A further aspect of the invention comprises a concentrate for dilution to form a liquor according to the present invention, said concentrate comprising more than 10%wt surfactant. This concentrate can be in solid or liquid form and is suitable for addition to water to form the liquor.

[0033] A yet further aspect of the invention subsists in the use of the liquor according to the present invention in the washing step of a laundering process for garments.

Detailed Description of the Invention

[0034] The invention is described below with particular reference to various preferred features of the compositions and methods that embody it. Preferably, the method of the invention is applied to textiles comprising cellulosic fibres, more preferably to textiles which comprise at least a proportion of cotton fibres, for example, cotton per se or cotton blends (i.e. cotton/polyester blends).

The deterative surfactant:

[0035] The purpose of the deterative surfactant is to clean. Many suitable detergent active compounds are available to the skilled worker and fully described in the literature, for example, in "Surface-Active Agents and Detergents", Volumes I and II, by Schwartz, Perry and Berch (published by Wiley Interscience).

[0036] The preferred surfactants that can be used are the soaps and, more preferably the synthetic non-soap anionic and nonionic compounds that are known and used in the formulation of detergent compositions suitable for laundry use.

[0037] Anionic surfactants are well-known to those skilled in the art. Examples include alkylbenzene sulphonates, particularly linear alkylbenzene sulphonates having an alkyl chain length of C₈-C₁₅; primary and secondary alkylsulphates, particularly C₈-C₁₅ primary alkyl sulphates; alkyl ether sulphates; olefin sulphonates; alkyl xylene sulphonates; dialkyl sulphasuccinates; and fatty acid ester sulphonates. Sodium salts are generally preferred.

[0038] Nonionic surfactants that may be used include the primary and secondary alcohol ethoxylates, especially the C₈-C₂₀ aliphatic alcohols ethoxylated with an average of from 1 to 20 moles of ethylene oxide per mole of alcohol, and more especially the C₁₀-C₁₅ primary and secondary aliphatic alcohols ethoxylated with an average of from 1 to 10 moles of ethylene oxide per mole of alcohol. Non-ethoxylated nonionic surfactants include alkylpolyglycosides, glycerol monoethers, and polyhydroxyamides (glucamide).

[0039] Cationic surfactants that may be used include quaternary ammonium salts of the general formula R₁R₂R₃R₄N⁺X⁻ wherein the R groups are independently hydrocarbyl chains of C₁-C₂₂ length, typically alkyl, hydroxyalkyl or ethoxylated alkyl groups, and X is a solubilising anion (for example, compounds in which R₁ is a C₈-C₂₂ alkyl group, preferably a C₈-C₁₀ or C₁₂-C₁₄ alkyl group, R₂ is a methyl group, and R₃ and R₄, which may be the same or different, are methyl or hydroxyethyl groups); and cationic esters (for example, choline esters) and pyridinium salts. As the present invention does not comprise a conditioner for use in the rinse, levels and types of the cationic as opposed to the other surfactants will be used which are deterative, i.e. adapted for cleaning, rather than conditioning.

[0040] The total quantity of detergent surfactant in the concentrate is suitably from 10 to 60 wt% e.g. 10 to 55 wt%, such as 10 to 50wt%. Higher levels of surfactant are preferred for reasons of transport economy and to reduce the levels of packaging employed.

[0041] Preferably, the quantity of anionic surfactant (when present) is in the range of from 1 to 50% by weight of the total concentrate. More preferably, the quantity of anionic surfactant is in the range of from 3 to 35% by weight, e.g. 5 to 30% by weight.

[0042] Preferably, the quantity of nonionic surfactant when present is in the range of from 2 to 25% by weight, again expressed in terms of the concentrate, more preferably from 5 to 20% by weight.

[0043] Amphoteric surfactants may also be used, for example amine oxides or betaines.

The particulate material:

[0044] As noted above it is believed that the particulate material acts, in part, to stiffen the fibres of the textile. Some evidence suggests that in the case of cotton this is accomplished by the adsorption to and coating of the cotton fibres.

Depending on the size of the particulate material, some may also enter the pores of the cotton fibres. These pores are about 9 nm diameter. Therefore at the lower end of the particle size range (5nm) there will be some entry of particles into the pores. The fact that the particles are positively charged assists in the interaction of the particles with cotton, as cotton tends to carry a slight negative charge.

[0045] It is believed that there is an interaction between the particles and the silicone droplets in the liquor and that this interaction is important both for the final deposition morphology of the components on fabrics and for the tactile attributes of the treated fabrics.

[0046] It is also believed that during drying the particles improve the extent and evenness of silicone spreading resulting in better and more even lubrication. This leads to an even soft feel all over the cloth. Silicone blend droplets without particles are less substantive to the fibre, and during drying a coalescence of droplets may occur that results in poor distribution across the cloth, which gives a 'greasy', patch-wise softness.

[0047] A particularly preferred particulate material (b) is a colloidal silica. Ludox SP532-10519, 50nm polydisperse cationic silica (ex Grace Davison) is a particularly suitable material.

The silicones:

[0048] The aminosilicone-containing blend (c) is characterised by both its composition and its particle size range.

[0049] The droplet size range of the aminosilicone-containing blend is preferably 5-15 microns. It is believed that this size range gives an excellent combination of deposition and dispersion on the substrate.

[0050] Suitable amino-functional silicones for use in the blend are those having a mole percent amino functionality in the range 0.5-2.5, for example 'Dow Corning 2-8566' (DC8566), commercially available from Dow-Corning as a thermal protection agent for hair as well as DC Q2-8220 commercially available from Dow-Corning as a conditioning additive.

[0051] The aminosilicone-containing blend comprises both silicone and amino silicone. The silicone is present in weight excess over the aminosilicone. The weight ratio of silicone to aminosilicone is in the range 20:1 to 3:1. At low relative levels of aminosilicone deposition of the silicone is poor and is not uniform. At low relative levels of silicone the feel becomes greasy and limp.

[0052] Weight ratios of around 9:1, preferably 12:1 to 6:1 (silicone/aminosilicone) are most particularly preferred. This ratio provides an excellent combination of deposition and tactile feel.

[0053] It is preferable that the silicone component of the silicone blend is viscous. More preferably the silicone should be significantly more viscous than the aminosilicone at a given shear rate and temperature. It is believed that this influences the visco-elastic properties of the fibres after treatment. However the silicone should not be so viscous as to be a rubber. Consequently it is preferable that the viscosity of the silicone is below 800,000 mPas.

[0054] Preferably, the viscosity of the silicone in the silicone blend is 100,000-600,000 mPas, at a temperature of 25°C. Suitable materials include 'Dow Corning 200(R) 300,000 CST', commercially available from Dow Corning.

[0055] Preferably, the viscosity of the amino-silicone in the silicone blend is less than 5000 mPas, at a temperature of 25°C. Suitable materials include DCQ8220, DC8566 ex Dow Corning, as discussed above.

[0056] The emulsified aminosilicone-containing blend is preferably present in weight excess over the particles. If an insufficient proportion of the aminosilicone-containing blend is used, the textiles become stiff. The preferred weight ratio of particulate material (b) to the emulsified blend (c) is in the range 1:10-50. Ratios of around 1:30 are particularly preferred. It is believed that at effective levels the particles associate with the surface of the emulsified blend and form a mono-layer that assists in deposition of the emulsion and its stability.

Preparation:

[0057] Compositions of the present invention are preferably prepared by separately preparing an emulsion of the silicone components, and then combining this with the particulate components. This pre-mix is then combined with the remaining components of the fully-formulated product.

[0058] It is convenient to use an emulsifier to stabilise the emulsion of silicone components. Suitable emulsifiers include nonionic surfactants, particularly ethoxylated alcohol nonionic surfactants. Suitable materials include 3%wt on emulsion of the non-ionic surfactants (Brij 30/35) and 3%wt on emulsion Pluronic 127.

[0059] An emulsion of silicone and aminosilicone suitable for use in the present invention is available from Dow Corning under the serial number DC 18371-140.

Product Form:

[0060] Fully formulated products according to the present invention can take the form of liquids and solids and the range of intermediate pastes and gels. These may be in unit dose format or dosed as required. The solids may be in the form of tablets or various shapes and sizes of particles down through pellets and granules to powders. The fully

formulated products may be homogeneous in composition or the components may be segregated to prevent unwanted interactions on storage or use.

[0061] In order that the present invention may be further and better understood it is described hereinafter with reference to various specific embodiments by way of example. These embodiments are not considered limiting although they further illustrate preferred and particular features of the invention.

Examples

[0062] The following paragraphs describe the preparation of materials used in the examples.

a) *Silicone Blend:-*

[0063] A silicone blend emulsion was obtained from Dow Corning as a sample identified by the code number DC 18371-140.

[0064] DC18371-140 is believed to be a blend of Linear PDMS of viscosity 200,000/300,000 mPaS (Dow Corning DC200(R) FLUID 300,000CST) and an aminosilicone (Dow Corning DCQ-8220) of viscosity 150 mPaS (25°C) in a ratio of 9:1 w/w: stabilised with 3%wt non-ionic surfactant Brij 30/35 (ex ICI) plus 3%wt Pluronic 127 (ex BASF).

[0065] The average droplet size was 10 µm and the viscosity of the blend was 240,000 mPaS at 25°.

b) *Preparation of the Silica/silicone Blend:*

[0066] The silicone blend emulsion as described above was mixed with silica particles Ludox SP532-10519 (polydisperse cationic silica, size of particles - 50 nm ex Grace Davison). No special mixing conditions are needed other than stirring at room temperature (at high temperature silica could gel within the silicone blend). The ratios used are given in the examples below, and the typical batch size for experimental purposes was around 100 mL.

c) *Preparation of the Wash Liquor:*

[0067] Silica/silicone Blend (b) was added by stirring to a model base formulation ('BASE') comprising a liquid detergent composition consisting a mixture of the surfactants LAS (BDA-2), SLES 3EO (BSS-T) and Neodol™ 25-7 in ratio 1:1:1 and demin water (hardness = 0.5 ppm as CaCO₃). The final surfactant dosage per wash was 1 g/l and the pH 8. If necessary pH was adjusted with Borax (STB).

Example 1: - washing experiments (softness panel testing)

[0068] In a model (Linitest™) wash, swatches of terry towelling (fabric weight 14g) were washed in the 'BASE' liquor described above at a 1:8 cloth to liquor weight.

[0069] Two add-on levels of silicone blend/silica on weight of fabric (owf) were used: 0.2 %owf, and 0.4 %owf. The samples were washed at 40°C for 45 min and then rinsed twice (10 min each of the rinses) with demin water. As a reference, terry towels were washed in the silicone blend alone (0.2 % owf) in the presence of the detergent base and in the presence of the base only.

[0070] After being washed and dried the cloths were conditioned at relative humidity 65% and 20°C for 24h and assessed for their softness properties via naïve and trained panel tests.

Table 1: - softness panel test results after washing

Treatment	Softness score High = good	Stiffness score low = good	Coated feeling score low = good
COMPARATIVE: Base only	30	55	43
COMPARATIVE: Base + silicone blend	34	52	45
EXAMPLE 1A: Base + silicone blend + silica (30:1)	45	42	38

(continued)

Treatment	Softness score High = good	Stiffness score low = good	Coated feeling score low = good
EXAMPLE 1B: Base + silicone blend + silica (1:2)	38	46	32

[0071] The results shown in table 1 were obtained at the add-on level 0.2 %owf with the trained panellists. The same trends were obtained in experiments with 0.4 %owf.

[0072] Both naive and trained tests showed the following. A softness benefit on terry towels at both applied ratios of silicone blend/silica system (1A - 30:1 and 1B - 1:2) over cloths washed only with base (see first comparative example). This is reflected in the higher scores for softness. Reduced stiffness and greasiness at both ratios silicone blend/silica compared to the softness delivered by the silicone blend alone (see second comparative example). This is reflected in the lower scores.

[0073] Wrinkling properties of fabrics were assessed on woven cotton sheeting and poplin monitors using two techniques: Crease recovery angle (CRA) and Wrinkle recovery test (WRT).

Example 2:- washing experiments (Crease Recovery Angle) :

[0074] Woven cotton sheeting fabrics (fabric weight 2.7g) were washed according the protocol described in example 1. The anti-creasing effect of silicone blend/silica system at varying ratios: (30/1, 3/1, 1/2) and silicone blend alone was evaluated at add-on level of 0.2 % ofw.

[0075] After being washed and line dried the cloths were ironed, conditioned at relative humidity 65% and 20°C for 24h and their crease recovery angle (CRA) was measured. This is done according to AATCC 66-1990 by:

- a) creasing a 5cm by 2.5cm cloth for 1 min under a load of 1kg,
- b) releasing the cloth and allowing the crease to unfold, and,
- c) measuring the angle of the crease recovery 1 min after the creased cloth is released.

[0076] Compared with swatches treated in the base only, the silicone blend alone gave anti-creasing effect of less than 15%, i.e. a less than 15% increase in the CRA was obtained.

[0077] Examples of the present invention using silicone blend/silica (1:2 and 3:1) gave an improvement of 25% in the CRA as compared with the swatches treated with base only. Silicone blend/silica at a ratio of 30:1 gave an improvement of 35% as compared with the base only swatches.

Example 3:- padding experiments (wrinkle recovery test):

[0078] In this example a wrinkle recovery test (WRT) was used to compare a range of technologies which are believed to give improved wrinkle recovery. A Werner Mathis AG padder was used for removing excess liquid from monitors by compression between two rubber rollers. The pressure applied to the fabric was selected by the user.

[0079] This method was used to apply a known amount of chemical treatment to cloths. The test solutions were prepared (strength = the desired % owf) and stabilised overnight on a roller bank. The general principle is that fabric is soaked in a solution of known composition then compressed between the rollers of the padder so that it retains double its original weight in solution - the so called "100% pick-up". It is therefore possible to calculate the amount of composition on the fabric given the strength of the starting solution.

[0080] Each test monitor was weighed (W1) and then soaked in the test solution. The monitor was then compressed between the rollers of the Werner Mathis AG padder until the weight = (W1 x 2). The padded monitor was then left to dry at controlled T and RH (20°C/65%RH) for 24 hours and then reweighed (W2). (W2 - W1) = weight of additive on fabric from which the %owf was then calculated.

[0081] All treatments were padded onto unresinated cotton poplin at 0.5% owf. Treated fabrics were pre-conditioned at 85% RH prior to creasing by being packed and sealed in polythene bags in an environmental chamber). Crease recovery was allowed to occur at 65% RH. The monitors were creased onto a Wrinkle Recovery Tester model 155 (supplied by James H Heal & Co Ltd) so that the warp direction was vertical. The fabric was then compressed (wrinkled) using no additional weight for 8 minutes. Monitors were imaged after 10 min and 24h recovery. A scale (the 'U'-scale)

covering a wide spectrum of wrinkles (0 = not wrinkled -flat and 10 = severely wrinkled) has been use to discriminate wrinkles. Compared to standard 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. Table 2 below shows the wrinkle scores obtained.

Table 2 - wrinkle scores (better results lower):

Treatment method used (all at 0.5% owf - padded onto cloth)	Score (10m) Lower = better	Score (24h) Lower = better
EXAMPLE: Silicone blend/ Silica according to invention	4.6	3.7
CONTROL: Unresinated Poplin	6.0	5.0
COMPARATIVE: Resinated Poplin (ex CIBA)	5.3	4.3
COMPARATIVE: Elastomer film former	5.4	4.3
COMPARATIVE: H-bond disrupter	5.5	4.5
COMPARATIVE: BTCA cross linker	4.7	4.3
COMPARATIVE: Low Tg film former	5.3	4.0

[0082] From the results given in Table 2 it can be seen that the silicone blend/silica system gave lower wrinkle scores than the other approaches listed. Silicone blend/silica technology showed the best anti-wrinkle score after both 10 min and 24h recovery.

Example 4: - Fabric damage:

[0083] The damage of blue drill cotton (ex Abakhan, Mostyn) padded with 0.2 % owf silicone blend/silica system (30: 1) was assessed through SEM analysis of fabric surface and measurement of the fabric-fabric friction coefficient using the Eldredge™ Tribometer. This was compared to the damage of untreated drill cotton after 100 cycles.

[0084] The surface friction measured at wet conditions (wash liquor, pH 10) for the drill cotton treated with silicone blend/silica system is significantly lower than the friction of untreated cloth at all friction conditions mentioned above. The following results were obtained.

Table 3 - frictional measurements (better results are lower)

Treatment	Speed	Cycles number	Friction coefficient
Silicone blend/silica (according to present invention)	10	0	0.73
		20	0.76
		40	0.76
		100	0.757
	40	0	0.747
		20	0.78
		40	0.79
		100	0.785
Untreated (control)	10	0	1.00
		20	1.02
		40	1.01
		100	1.01
	40	0	0.94
		20	0.93
		40	0.92
		100	0.92

[0085] SEM images showed less surface damage on the fabrics treated with silicone blend/silica compared to untreated

fabrics.

Example 5: - Microscopic studies:

- 5 **[0086]** Optical, SEM and SEM-Si mapping using an electron probe micro-analyser (EPMA) was performed on cotton fibers treated with silica/silicone blend mixtures and with the silicone blend alone. When the blend is used alone there is patchy deposition on the cotton fibres. In the presence of silica the deposition is far more uniform.

Example 6: - Single fiber stress/strain measurements:

- 10 **[0087]** Dia-stron™ stress strain and stress relaxation tests were used to measure the effect of silica/silicone blend system on a single cotton fibre. Silica/silicone blend treatment showed a measurable stiffening effect on the fibre.

Example 7: - Skin/Fabric interactions:

- 15 **[0088]** Blood flux and skin itch response to histamine challenge were both measured for cotton sheeting fabrics treated with silicone blend/silica system. Silicone blend/silica system shows low blood flow response to fabric-evoked abrasion, and no wheal/itch responses to histamine challenge.

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Claims

1. An aqueous textile treatment liquor suitable for use in a domestic laundering process comprising:
- 25 a) 0.1-10g/L of a deterative surfactant,
b) 0.001-1g/L positively charged, particulate material having a particle size of 5-200nm, and,
c) 0.001-1g/L of an emulsified, water-dispersible silicone blend comprising both silicone and at least one amino-silicone, the weight ratio of silicone to amino silicone being in the range 20:1 to 3:1 and said silicone blend having a droplet size of 5-20 microns.
- 30 2. A liquor as claimed in claim 1 wherein the particulate material (b) is a colloidal silica.
3. A liquor as claimed in claim 1 wherein the weight ratio of particulate material (b) to the emulsified blend (c) is in the range 1:10-50.
- 35 4. A liquor as claimed in claim 2 wherein the viscosity of the silicone in the silicone blend is 100,000-600,000 mPas.
5. A liquor as claimed in claim 2 wherein the viscosity of the amino-silicone in the silicone blend is 1000-5000 mPas.
- 40 6. A liquor as claimed in claim 1 wherein the surfactant comprises an anionic surfactant.
7. A concentrate for dilution to form the liquor of any preceding claim, said concentrate comprising more than 10%wt surfactant.
- 45 8. Use of a liquor according to any preceding claim in the washing step of a laundering process for garments.

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EUROPEAN SEARCH REPORT

Application Number
EP 06 07 6329

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