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(54) STABLE SILICONE OIL EMULSION COMPOSITION, ARTICLE OF MANUFACTURE, AND METHOD OF FABRIC WRINKLE CONTROL

STABILE SILICONÖLEMULSIONZUSAMMENSETZUNG, GEGENSTAND DIESE ENTHALTEND UND VERFAHREN ZUR REGULIERUNG VON KNITTERFALTEN

COMPOSITION D'EMULSION D'HUILE DE SILICONE STABLE, ARTICLE DE FABRICATION ET PROCEDE D'ELIMINATION DES PLIS D'UN TISSU

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articles of manufacture that comprise such fabric wrinkle controlling compositions. The fabric wrinkle control compositions comprise:

(A) an effective amount to control wrinkles in fabric of a silicone oil, preferably selected from the group consisting of essentially hydrophobic silicones, silicones fluid at room temperature such as volatile silicones, and mixtures thereof; wherein the silicone oil is present at a level of at least about 0.025%, preferably at least about 0.05%, more preferably at least about 0.1%, and still more preferably at least about 0.5%, and at a level of no greater than about 10%, preferably no greater than about 5%, more preferably no greater than about 3%, and still more preferably no greater than about 1.5% by weight of the usage composition;

(B) an effective amount to emulsify the silicone oil and reduce surface tension of the composition of a surfactant system, comprising (1) a nonionic silicone surfactant, preferably an ethoxylated polydimethylsiloxane, (2) a conventional nonionic surfactant, preferably an alkyl ethoxylate, and (3) an ionic surfactant, preferably an alkyl sulfate; wherein each surfactant is present at a specific ratio with respect to the silicone oil to achieve maximum stability with the minimal amount of surfactant in order to minimize fabric staining;

(C) an effective amount of a buffering system having effective buffering capacity to prevent the pH of said composition from dropping and thereby to stop and/or diminish the surfactant degradation to therefore prevent instability of said composition and silicone oil creaming out of said composition; wherein the buffering system preferably comprises a compound or compounds that generate an acid-base conjugate pair, or a salt together with an acid or a base, that maintains the pH of the composition to be at least about 6, preferably maintains the pH of the composition to be at least about 7, more preferably maintains the pH of the composition to be at least about 7.5 and even more preferably maintains the pH of the composition to be at least about 8; wherein the buffering system maintains the pH of the composition to be no greater than about 12, preferably no greater than about 10, more preferably no greater than about 9, and even more preferably no greater than about 8.5; wherein the buffering system can further comprise additional salt to achieve and maintain the appropriate pH by increasing ionic strength and thus the buffering capacity of the buffering system; wherein the buffering capacity of the buffering system is preferably at least about 0.01, and more preferably at least about 0.02; wherein the pH is maintained for a period of at least about 3 months, preferably at least about 6 months, more preferably at least about 12 months, even more preferably at least about 18 months, and still more preferably at least about 24 months; and

(D) carrier, preferably water.

[0010] The preferred clear, or translucent silicone oil emulsion compositions of the present invention can optionally further comprise:

(A) optionally, an effective amount of a supplemental wrinkle control agent selected from the group consisting of (1) fabric (fiber) lubricant, (2) shape retention polymer, (3) lithium salts, (4) hydrophilic plasticizers and (5) mixtures thereof;

(B) optionally, an effective amount to soften fibers and/or soften any shape retention polymer, when present, of hydrophilic plasticizer wrinkle control agent;

(C) optionally, but preferably, at least an effective amount to absorb or reduce malodor, of odor control agent;

(D) optionally, but preferably, an effective amount to provide olfactory effects of perfume;

(E) optionally, an effective amount, to kill, or reduce the growth of microbes, of antimicrobial active;

(F) optionally, an effective amount to provide improved antimicrobial action for, e.g., the antimicrobial active, of aminocarboxylate chelator;

(G) optionally, other ingredients such as adjunct odor-controlling materials, chelating agents, additional antistatic agents if more static control is desired, insect and moth repelling agents, colorants, especially bluing agents, antioxidants; and

(H) mixtures of optional components (A) through (G).

[0011] The present preferred silicone emulsion compositions are preferably essentially free of any material that would soil or stain fabric under usage conditions, or preferably essentially free of materials at a level that would soil or stain fabrics unacceptably under usage conditions. The buffering system of the present compositions preferably comprises tris(hydroxymethyl)aminomethane and hydrogen chloride. The present compositions are preferably applied as small droplets to fabric when used as a wrinkle spray.

[0012] The present invention also relates to concentrated compositions, which are diluted to form compositions with the usage concentrations for use under usage conditions.

[0013] The present invention further relates to a method of making the present compositions and to an accelerated stability test method to identify products with preferred stability.

[0014] The present invention also relates to articles of manufacture comprising the present compositions incorporated

ratio that is as low as possible together with the water solubility of the silicone oil means that the formulation is susceptible to loss of stability and creaming if any of the surfactant system is lost via degradative processes.

[0023] The preferred surfactant system for emulsifying silicone oil comprises a silicone containing nonionic surfactant, a conventional nonionic surfactant, and an ionic surfactant. A preferred ionic surfactant for use in this system is alkyl sulfate. Ethoxylated surfactants as well as alkyl sulfates have a tendency to degrade in aqueous solutions even under moderate conditions and particularly when the pH of the system is below about 6. It is observed during formulation work that emulsions at pHs below about 6 rapidly degraded resulting in very unstable, extremely cloudy systems, which in many cases actually separated into at least two layers under even ambient conditions. However, it is suprisingly not sufficient to simply adjust the pH above about 6 using a small amount of strong base such as NaOH, as the formulations would simply begin to drift down in pH, a process that became increasing rapid as the system approached a pH below about 5. These systems, although they were initially adjusted to pH's above about 6 also became very unstable and extremely cloudy as the pH drifted downward.

[0024] Aqueous compositions can absorb CO_2 from the atmosphere and this will cause the pH of an aqueous based formulation to drop below about 6 as the CO_2 forms carbonic acid in water and then disassociates (*Chemistry the Central Science*, T.L. Brown and H.E. LeMay, Jr.). Concurrent with this drop in pH and exacerbated by it, nonionic surfactants, such as ethoxylated surfactants, begin to degrade via auto-oxidation ("The Stability of the Polyoxyethylene Chain" by Max Donbrow in Nonionic Surfactants Physical Chemistry, ed. Martin J. Schick, Marcel Dekker, Inc. 1987) and anionic surfactants, such as alkyl sulfate surfactants hydrolyze. When surfactants such as alkyl sulfates hydrolyze, fatty alcohol and sulfuric acid are formed. Although this process is not rapid, sulfuric acid is a very strong acid and so small amounts have a strong impact on unbuffered systems, thus contributing to lowering the pH. While surfactants such as ethoxylated surfactants will auto-oxidize at ambient conditions, the rate of degradation of the ethoxylated surfactants is accelerated at lower pH's, a process that eventually produces carboxylic acids, thus lowering pH and further driving surfactant degradation. Suprisingly, it is found that polyalkylene oxide polysiloxanes which have a very low aqueous surface tension and therefore are particularly preferred for compositions of the present invention are also especially susceptible to degration at lower or higher pH's. Even minimal degradation of surfactants leads to loss of product stability and eventually separation of the oil and aqueous phases, especially in compositions with particular surfactant to silicone oil ratios.

[0025] Since it is a goal of this invention and article of manufacture to minimize fabric staining by limiting application to fabric of components likely to cause staining, e.g. surfactants, it is not acceptable to address the formula stability problem by simply increasing surfactant levels. However, it is suprisingly possible to slow or stop degradation of the surfactant system by adding a buffering system with sufficient buffer capacity to prevent the pH drop due to the various chemical processes and thus slow degradation and stabilize compositions. Buffers provide additional benefits by improving stability at both high (about 120°F) (49°C) and low (about 0°F) (-18°C) temperatures which is optimal for shipping of manufactured products. Buffers can also increase the hydrogen-bond breaking effectiveness of the formulations thus contributing to improved wrinkle removal.

[0026] It is further interesting to note that nonionic surfactants preferred for compositions disclosed herein tend to be very immiscible in water at levels disclosed herein. It appears to be a property of the silicone oil to improve the miscibility of these surfactants by providing an oil/water interface the surfactants can organize around, thus guaranteeing the polar head groups of the surfactants will be most exposed to the water domain and therefore enhancing the solubility of these surfactants. Just as the surfactant system acts to emulsify the silicone oil, to make the silicone oil miscible in water, the silicone oil also acts to enhance the miscibility of the surfactant system in water. Therefore, it is most advantageous to exercise measures that prevent Oswald ripening because Oswald ripening normally leads to a situation in which the larger emulsion droplets will continue to increase their size and oil content to become larger emulsion droplets at the expense of smaller emulsion droplets which continue to diminish in size and loose oil content. As Oswald ripening continues, the emulsion droplets loosing oil tend to separate from the aqueous phase since the water miscibility of the surfactant is lower than the water miscibility of the surfactant plus oil. Concurrently, the larger droplets tend to coalesce and form even larger emulsion droplets until the surfactant at the interface can no longer contain the oil, which then also separates.

[0027] The preferred silicone oil emulsion compositions of the present invention typically comprise:

(A) an effective amount to control wrinkles in fabric of a silicone oil, preferably selected from the group consisting of essentially hydrophobic silicones, silicones fluid at room temperature such as volatile silicones, and mixtures thereof; wherein the silicone oil is present at a level of at least about 0.025%, preferably at least about 0.05%, more preferably at least about 0.1%, even more preferably at least about 0.2%, still more preferably at least about 0.4%, and most preferably at least about 0.5% by weight of the usage composition and at a level of no greater than about 10%, preferably no greater than about 5%, more preferably no greater than about 3%, even more preferably no greater than about 2.7%, still more preferably no greater than about 2%, and most preferably no greater than about 1.5% by weight of the usage composition;

(B) an effective amount to emulsify the silicone oil and reduce surface tension of the composition of a surfactant

due to their volatile nature. The volatile silicones also provide a desirable control over the formation of wrinkles in fabrics while the fabrics are being dried.

[0031] Nonlimiting examples of useful silicones in the compositions of the present invention include noncurable silicones such as volatile silicones and polydimethylsilicone, and curable silicones such as aminosilicones, phenylsilicones and hydroxysilicones. Also useful in the present compositions are silicone emulsions that comprise silicone oils such as 346 Emulsion, 347 Emulsion, and HV-490 available from Dow Corning. Preferably, the silicones are hydrophobic, and are neither irritating, toxic, nor otherwise harmful when applied to fabric or when they come in contact with human skin, and are chemically stable under normal use and storage conditions, and are capable of being deposited on fabric.

[0032] When the composition of this invention is to be dispensed from a spray dispenser in a consumer household setting, the noncurable silicones such as polydimethylsilicone, and especially the volatile silicones, are preferred. Curable and/or reactive silicones such as amino-functional silicones and silicones with reactive groups such as Si-OH, Si-H, silanes, and the like, are not preferred in this situation, because the portion of the composition that is sprayed but misses the garment, and falls instead on flooring surfaces, such as rug, carpet, concrete floor, tiled floor, linoleum floor, bathtub floor, can leave a silicone layer that is cured and/or bonded to the flooring surfaces. Such silicones that are bonded to surfaces are difficult to remove from the flooring surfaces. The flooring surfaces thus become slippery and can present a safety hazard to the household members. The curable and reactive silicones can be used in compositions specifically designed for use in enclosed areas such as in a dewrinkling enclosure, e.g., cabinet. Many types of aminofunctional silicones also cause fabric yellowing. Thus, the silicones that cause fabric discoloration are also not preferred. Indeed, the present compositions are preferably essentially free of any material that would soil or stain fabrics or are essentially free of material at a level that would soil or stain fabrics.

[0033] The preferred silicone is volatile silicone fluid which can be cyclic silicone fluid of the formula $[(CH_3)_2SiO]_n$ where n ranges between about 3 to about 7, preferably about 5, or a linear silicone polymer fluid having the formula $(CH_3)_3SiO[(CH_3)_2SiO]_mSi(CH_3)_3$ where m can be 0 or greater and has an average value such that the viscosity at 25°C of the silicone fluid is preferably about 5 centistokes or less.

[0034] The non-volatile silicones that are useful in the composition of the present invention are polyalkyl and/or phenylsilicones silicone fluids and gums with the following structure:

$$A\text{-}Si(R_2)\text{-}O\text{-}[Si(R_2)\text{-}O\text{-}]_q\text{-}Si(R_2)\text{-}A$$

[0035] The alkyl groups substituted on the siloxane chain (R) or at the ends of the siloxane chains (A) can have any structure as long as the resulting silicones remain fluid at room temperature.

[0036] Each R group preferably can be alkyl, aryl, hydroxy, or hydroxyalkyl group, and mixtures thereof, more preferably, each R is methyl, ethyl, propyl or phenyl group, most preferably R is methyl. Each A group which blocks the ends of the silicone chain can be hydrogen, methyl, methoxy, ethoxy, hydroxy, propoxy, and aryloxy group, preferably methyl. Suitable A groups include hydrogen, methyl, methoxy, ethoxy, hydroxy, and propoxy. q is preferably an integer from about 7 to about 8,000. The preferred silicones are polydimethyl siloxanes; more preferred silicones are polydimethyl siloxanes having a viscosity of from about 50 to about 1000,000 centistokes at 25°C. Mixtures of volatile silicones and non-volatile polydimethyl siloxanes are also preferred. Suitable examples include silicones offered by Dow Corning Corporation under the trade names 200 Fluid and 245 Fluid, and the General Electric Company under the trade names SF1173, SF 1202, SF 1204, SF96, and Viscasil®.

[0037] Other useful silicone materials, but less preferred than polydimethylsiloxanes, include materials of the formula:

$$HO\text{-}[Si(CH_3)_2\text{-}O]_x\text{-}\{Si(OH)[(CH_2)_3\text{-}NH\text{-}(CH_2)_2\text{-}NH_2]O\}_y\text{-}H$$

wherein x and y are integers which depend on the molecular weight of the silicone, preferably having a viscosity of from about 10,000 cst to about 500,000 cst at 25°C. This material is also known as "amodimethicone". Although silicones with a high number, e.g., greater than about 0.5 millimolar equivalent of amine groups can be used, they are not preferred because they can cause fabric yellowing.

[0038] Similarly, silicone materials which can be used correspond to the formulas:

$$(R^1)_aG_{3-a}\text{-}Si\text{-}(\text{-}OSiG_2)_n\text{-}(OSiG_b(R^1)_{2-b})_m\text{-}O\text{-}SiG_{3-a}(R^1)_a$$

wherein G is selected from the group consisting of hydrogen, phenyl, OH, and/or C_1-C_8 alkyl; a denotes 0 or an integer from 1 to 3; b denotes 0 or 1; the sum of n+m is a number from 1 to about 2,000; R^1 is a monovalent radical of formula $C_pH_{2p}L$ in which p is an integer from 2 to 8 and L is selected from the group consisting of:

$-N(R^2)CH_2\text{-}CH_2\text{-}N(R^2)_2$;
$-N(R^2)_2$;

wherein a + b are from about 1 to about 50, preferably from about 1 to about 30 , more preferably from about 1 to about 25, and each R^1 is the same or different and is selected from the group consisting of methyl and a poly(ethyleneoxide/propyleneoxide) copolymer group having the general formula:

$$-(CH_2)_n O(C_2H_4O)_c (C_3H_6O)_d R^2$$

with at least one R^1 being a poly(ethyleneoxy/propyleneoxy) copolymer group, and wherein n is 3 or 4, preferably 3; total c (for all polyalkyleneoxy side groups) has a value of from 1 to about 100, preferably from about 6 to about 100; total d is from 0 to about 14, preferably from 0 to about 3; and more preferably d is 0; total c+d has a value of from about 5 to about 150, preferably from about 7 to about 100 and each R^2 is the same or different and is selected from the group consisting of hydrogen, an alkyl having 1 to 4 carbon atoms, and an acetyl group, preferably hydrogen and/or methyl group. Each polyalkylene oxide polysiloxane has at least one R^1 group being a poly(ethyleneoxide/propyleneoxide) copolymer group.

[0045] Nonlimiting examples of these type of surfactants are the Silwet® surfactants which are available OSI Specialties Inc., a Division of Witco, Danbury, Connecticut. Representative Silwet® surfactants which contain only ethyleneoxy (C_2H_4O) groups are as follows.

Name	Average MW	Average a+b	Average total c
L-7608	600	1	8
L-7607	1,000	2	17
L-77	600	1	9
L-7605	6,000	20	99
L-7604	4,000	21	53
L-7600	4,000	11	68
L-7657	5,000	20	76
L-7602	3,000	20	29
L-7622	10,000	88	75

[0046] Nonlimiting examples of Silwet® surfactants which contain both ethyleneoxy (C_2H_4O) and propyleneoxy (C_3H_6O) groups are as follows:

Name	Average MW	EO/PO ratio
L-720	12,000	50/50
L-7001	20,000	40/60
L-7002	8,000	50/50
L-7210	13,000	20/80
L-7200	19,000	75/25
L-7220	17,000	20/80

[0047] Some nonlimiting preferred Dow Corning® polyalkylene oxide polysiloxanes include Dow Corning® 190 Dow Corning® Q2-5211. Other nonlimiting examples of polyalkylene oxide polysiloxanes useful in the present invention include include the following compounds available from Dow Corning® 193, FF-400 Fluid, Q2-5220, Q4-3667, as well as compounds available from Toray Dow Corning Silicone Co., Ltd. know as SH3771C, SH3772C, SH3773C, SH3746, SH3748, SH3749, SH8400, SF8410, and SH8700, KF351 (A), KF352 (A), KF354 (A), and KF615 (A) of Shin-Etsu Chemical Co., Ltd., TSF4440, TSF4445, TSF4446, TSF4452 of Toshiba Silicone Co and the following compound GE Silicones SF1288, .

[0048] The molecular weight of the polyalkyleneoxy group (R^1) is less than or equal to about 10,000. Preferably, the molecular weight of the polyalkyleneoxy group is less than or equal to about 8,000, and most preferably ranges from about 300 to about 5,000. Thus, the values of c and d can be those numbers which provide molecular weights within these ranges. However, the number of ethyleneoxy units ($-C_2H_4O$) in the polyether chain (R^1) must be sufficient to render the polyalkylene oxide polysiloxane water dispersible or water soluble. If propyleneoxy groups are present in the polyalkylenoxy chain, they can be distributed randomly in the chain or exist as blocks. Surfactants which contain only propyleneoxy groups without ethyleneoxy groups are not preferred. Preferred polyalkylene oxide polysiloxanes surfactants have an aqueous surface tension below about 32 mN/m, such as Silwets® L-7657 and L-7605 even more preferred are polyalkylene oxide polysiloxanes surfactants with a surface tension below about 30 mN/m, such as L-7602

can also solubilize and/or disperse shape retention polymers such as copolymers containing acrylic acid and tert-butyl acrylate into clear compositions, even without the presence of a low molecular weight alcohol.

[0055] Other useful nonionic alkyl alkoxylated surfactants are ethoxylated alkyl amines derived from the condensation of ethylene oxide with hydrophobic alkyl amines, with R^8 having from about 8 to about 22 carbon atoms and s being from about 3 to about 30.

[0056] Other examples of useful ethoxylated surfactant include carboxylated alcohol ethoxylate, also known as ether carboxylate, with R^8 having from about 12 to about 16 carbon atoms and s being from about 5 to about 13; ethoxylated alkyl amine or quaternary ammonium surfactants, R^8 having from about 8 to about 22 carbon atoms and s being from about 3 to about 30, such as PEG-5 cocomonium methosulfate, PEG-15 cocomonium chloride, PEG-15 oleammonium chloride and bis(polyethoxyethanol)tallow ammonium chloride.

[0057] Additional suitable nonionic surfactants include surfactants derived from carbohydrates such as sorbitan esters, especially sorbitan monoesters, also alkyl glucosides, and alkyl polyglucosides. A specific description of many surfactants which are derived from carbohydrates can be found in *Handbook of Surfactants*, M.R. Porter, 1991, Blackie & Son Ltd, pp. 142-145. Glucamines are additional examples of surfactants derived from carbohydrates (U.S. Pat. No. 5,194,639 issued March 16, 1993 to D.S. Connor, J.J. Scheibel, and R.G. Severson; U.S. Pat. No. 5,338,487 issued August 16, 1993 to D.S. Connor, J.J. Scheibel, and J.-N. Kao; U.S. Pat. No.5,489,393 issued February 6, 1996 to D.S. Connor, J.J. Scheibel, and Y.C. Fu; and U.S. Pat. No. 5,512,699 issued April 30, 1996 to D.S. Connor, Y.C. Fu, and J.J. Scheibel). Preferred alkyl polyglucosides are those having aqueous surface tension below about 35 mN/m such as AG 6202 and AG6210 from Akzo Nobel Chemicals, Inc., Chicago, IL.

[0058] The conventional nonionic surfactant is incorporated in the present compositions at a level based on the amount of silicone oil in the composition, wherein the ratio of conventional nonionic surfactant:silicone oil, by weight, is no greater than about 1.0:1, preferably no greater than about 0.8:1, more preferably no greater than about 0.75:1, even more preferably no greater than about 0.5:1, still more preferably no greater than about 0.25:1, and most preferably no greater than about 0.2:1. The ratio of conventional nonionic surfactant:silicone oil, by weight, is at least about 0.001:1, preferably at least about 0.01:1, more preferably at least about 0.025:1, still more preferably at least about 0.05:1, and most preferably at least about 0.1:1.

(3) Ionic Surfactant

[0059] Ionic surfactants are essential ingredient within compositions disclosed herein to aid in solubilizing sparing soluble, but preferred, nonionic surfactants. Ionic surfactants tend to improve the water miscibility, dispersibility, and/or solubility of such nonionic surfactants, especially the more sparingly soluble nonionic surfactants by forming comicelles to slow or prevent condensation of the nonionics. Normally, a 2% solution of a sparingly soluble nonionic surfactant, such as Silwet® L77, will be cloudy indicating separation of surfactant particles from water. Addition of small amounts of ionic surfactants, e.g. less than about 1%, into an approximately 2% solution of sparingly soluble nonionic solution will usually cause the solution to become clear, indicating that the nonionic surfactant is more miscible, dispersed in smaller particles, and/or more soluble in combination with the ionic surfactant. Combination of ionic surfactant with the nonionic surfactants also results in improved emulsion stability especially at the minimal surfactant to silicone oil ratios useful for this invention. A co-micelle that is formed between the nonionic and the ionic surfactant typically has a greater charge versus a micelle composed of only nonionic surfactants. The greater charge on the co-micelles causes emulsion droplets/particles to repel each other thus slowing or preventing coalescence of droplets and eventual phase separation, particular at higher temperatures where this type of behavior is typically accelerated.

[0060] Nonlimiting preferred ionic surfactants are the class of anionic surfactants. Anionic surfactants are preferred ionic surfactants since they are least likely to leave residues. Alkyl sulfates are a particularly preferred, but nonlimiting, class of anionic surfactants for use in compositions disclosed herein. Many suitable nonlimiting examples from the class of anionic surfactants can be found in *Surfactants and Interfacial Phenomena*, 2nd Ed., Milton J. Rosen, 1989, John Wiley & Sons, Inc., pp. 7-16, which is hereby incorporated by reference. Additional suitable nonlimiting examples of anionic surfactants can be found in *Handbook of Surfactants*, M.R. Porter, 1991, Blackie & Son Ltd, pp. 54-115 and references therein.

[0061] Structurally, suitable anionic surfactants contain at least one hydrophobic moiety and at least one hydrophilic moiety. The surfactant can contain multiple hydrophobic moieties and/or multiple hydrophilic moieties, but preferably less than or equal to about 2 hydrophobic moieties and less than or equal to about 3 hydrophilic moieties. The hydrophobic moiety is typically comprised of hydrocarbons either as an alkyl group or an alkyl-aryl group. Alkyl groups typically contain from about 6 to about 22 carbons, preferably about 10 to about 18 carbons, and more preferably from about 12 to about 16 carbons; aryl groups typically contain alkyl groups containing from about 4 to about 6 carbons. Each alkyl group can be a branched or linear chain and is either saturated or unsaturated. A typical aryl group is benzene. Some typical hydrophilic groups for anionic surfactants include but are not limited to $-CO_2^-$, $-OSO_3^-$, $-SO_3^-$, $-(OR_1)_x-CO_2^-$, $-(OR_1)_x-OSO_3^-$, $-(OR_1)_x-SO_3^-$. With x being less than about 10 and preferably less than about 5. Some nonlimiting

[0067] Buffering capacity of a system, in this case the present compositions, can be calculated from the following equation:

$$dB/dpH = 2.3\ K_a\ C\ [H^+]\ /\ (\ K_a\ +\ [H^+]\ )^2$$

wherein K_a = the ionization constant of the buffer, C = the concentration of the buffer and $[H^+]$ = the initial concentration of the hydrogen ion in the composition. As an example, simply adjusting the pH using a weak base, like triethanolamine, is not sufficient to provide necessary buffering capacity to this system, and the above calculation is performed for the amount of triethanolamine necessary to raise the pH of the a composition from pH = 6.8 (a typical pH for the deionized water used to formulate the said composition) to pH = 9, a preferred pH level for the said composition. For triethanolamine the $K_a = 1.2 \times 10^{-8}$ and the initial = 1×10^{-9}. The amount of triethanolamine necessary to raise the pH from 6.8 to 9 is 0.1 g per liter or 6.7×10^{-4}. The buffering capacity of the above system is equal to:

$$2.3\ (1.2 \times 10^{-8})(6.7 \times 10^{-4})(\ 1 \times 10^{-9})\ /\ (1.2 \times 10^{-8} + 1 \times 10^{-9}\ )^2 = 0.00011$$

This result indicates that a composition where pH is simply raised to a high pH by a base, even a buffering base such as triethanolamine, has *very little* buffering capacity. The buffering capacity indicates that it takes only 0.00011 gram equivalents per liter of a strong acid to change the pH by one unit. Such a system is not robust to pH drift over time and tends to de-emulsify. The buffering capacity introduces an important concept - the concentration (or level) of the buffer in the composition is important because the concentration of buffer present is directly related to how much hydrogen ion the system can absorb without significant changes in pH. A thorough discussion of buffering capacity and the theory associated with it is given in the treatise "On the Measurement of Buffer Values and on the Relationship of Buffer Value to the Dissociation Constant of the Buffer and the Concentration and Reaction of the Buffer Solution" by Donald D. Van Slyke, *J. Biol. Chem.*, volume 52, pp 525-570, 1922.

[0068] Many commonly used buffers are listed and discussed in the book *Buffers for pH and Metal Ion Control* by D.D. Perrin and B. Dempsey (John Wiley & Sons, 1974) and in references therein, which are hereby incorporated by reference. Buffering agents preferred for use in the compositions discussed herein are selected from the group consisting of buffering systems, acid-base conjugate pairs, and salts together with an acid or a base, which are incorporated in the present compositions at a level that maintains the pH of the composition to be at least about 6, preferably at least about 7, and more preferably at least about 7.5, and even more preferably at least about 8 for a period of at least about 3 months, preferably at least about 6 months, more preferably at least about 12 months, even more preferably at least about 18 months, and still more preferably at least about 24 months. Buffering agents are preferably incorporated in the present compositions at a level that maintains the pH of the composition to be no greater than about 12, more preferably no greater than about 10, even more preferably no greater than about 9, and most preferably no greater than about 8.5 for a period of at least about 3 months, preferably at least about 6 months, more preferably at least about 12 months, even more preferably at least about 18 months, and still more preferably at least about 24 months. Some nonlimiting examples of preferred buffer systems include the Tris/HCl pair (Tris = Tris (hydroxymethyl) aminomethane available from the Angus® Chemical Co. St. Louis, Mo.), Borax/HCl (Borax is available from U.S. Borax, Inc., Valencia, CA), Diethanolamine/HCl (Diethanolamine is available from Dow Chemial, Midland, MI), sodium borate/NaOH (sodium borate is available from U.S. Borax, Inc., Valencia, CA), sodium bicarbonate/NaOH (sodium bicarbonate is available from the FMC Corporation, Philadelphia, PA), sodium hydrogen phosphate/NaOH (sodium hydrogen phosphate is available from Monsanto, St. Louis, MO), sodium carbonate/sodium bicarbonate (sodium carbonate and sodium bicarbonate are available from FMC Corporation, Philadelphia, PA), boric acid/NaOH (boric acid is available from U.S. Borax, Inc., Valencia, CA), glycine/NaOH (glycine is available from Sigma Chemcial, Inc, St. Louis, MO), and KCl/NaOH (KCl is available from North American Chemical Co., Overland Pk., KS). Sodium hydroxide is available from FMC Corporation, Philadelphia, PA and hydrogen chloride is available from Air Products and Chemicals, Inc., Allentown, PA.

[0069] An effective amount of a buffering system wherein the concentration of all components of the buffering system including the acid-base conjugate pair as well as any salt used to boost the buffering capacity typically constitute from about 0.05% to about 10%, preferably from about 0.02% to about 8%, more preferably from about 0.1 % to about 5%, and most preferably from about 0.2% to about 2.5% of the composition by weight. Preferred buffering systems are chosen from the group consisting of, but not limited to, buffering systems, acid-base conjugate pairs, and salts paired with an acid or a base, or self-buffering compounds and together with any salt intended to improve the buffering capacity of the system and utilized at a level that maintains the pH of the composition to be at least about 6, preferably at least about 7, more preferably at least about 7.5, and even more preferably at least about 8 for a period of at least about 3

quaternary ammonium compounds that contain hydrocarbon groups, including substituted groups and groups that are part of, e.g., acyl groups, which are unsaturated or branched are particularly suited for this composition. In some cases, amine precursors of the quaternary ammonium compounds can themselves be useful in this composition.

[0078] Typical levels of incorporation of the quaternary ammonium compound (active) in the wrinkle composition are of from about 0.025% to about 10% by weight, preferably from about 0.05% to about 5%, more preferably from about 0.1% to about 3%, and even more preferably from about 0.2% to about 2%, by weight of the composition, and preferably is biodegradable as disclosed hereinafter.

[0079] Suitable quaternary ammonium compounds for use in the wrinkle composition have been previously disclosed in U. S. Pat. No. 5,759,990, issued Jun. 2, 1998 in the names of E. H. Wahl, H. B. Tordil, T. Trinh, E. R. Carr, R. O. Keys, and L. M. Meyer, for Concentrated Fabric Softening Composition with Good Freeze/Thaw Recovery and Highly Unsaturated Fabric Softener Compound Therefor, and in U. S. Pat. No. 5,747,443, issued May 5, 1998 in the names of Wahl, Trinh, Gosselink, Letton, and Sivik for Fabric Softening Compound/Composition. An indicator of the suitability of quaternary ammonium actives for use in the compositions of the present invention is the phase transition temperature. Preferably, the phase transition temperature of the quaternary ammonium active or mixture of actives, containing less than about 5% organic solvent or water, is less than about 70°C, preferably less than about 50°C, more preferably less than about 35°C, even more preferably less than about 20°C, and yet even more preferably less than about 10°C, or is amorphous and has no significant endothermic phase transition in the region from about - 50°C to about 100°C.

[0080] The phase transition temperature can be measured with a Mettler TA 3000 differential scanning calorimeter with Mettler TC 10A Processor.

[0081] Typical suitable quaternary ammonium compounds or amine precursors are defined hereinafter.

Preferred Diester Quaternary Ammonium Active Compound (DEQA)

[0082]

(1) The first type of DEQA preferably comprises, as the principal active, [DEQA (1)] compounds of the formula

$$\{R_{4-m} - N^+ - [(CH_2)_n - Y - R^1]_m\}\ X^-$$

wherein each R substituent is either hydrogen, a short chain C_1-C_6, preferably C_1-C_3 alkyl or hydroxyalkyl group, e.g., methyl (most preferred), ethyl, propyl, hydroxyethyl, and the like, poly (C_{2-3} alkoxy), preferably polyethoxy, group, benzyl, or mixtures thereof; each m is 2 or 3; each n is from 1 to about 4, preferably 2; each Y is -O-(O)C-, -C(O)-O-, -NR-C(O)-, or -C(O)-NR-; the sum of carbons in each R^1, plus one when Y is -O-(O)C- or -NR-C(O) -, is C_{12}-C_{22}, preferably C_{14}-C_{20}, with each R^1 being a hydrocarbyl, or substituted hydrocarbyl group, and X^- can be any quaternary ammonium-compatible anion, preferably, chloride, bromide, methylsulfate, ethylsulfate, sulfate, and nitrate, more preferably chloride or methyl sulfate (As used herein, the "percent of quaternary ammonium active" containing a given R^1 group is based upon taking a percentage of the total active based upon the percentage that the given R^1 group is, of the total R^1 groups present.);

(2) A second type of DEQA active [DEQA (2)] has the formula:

$$[R_3N^+CH_2CH(YR^1)(CH_2YR^1)]\ X^-$$

wherein each Y, R, R^1, and X^- have the same meanings as before. Such compounds include those having the formula:

$$[CH_3]_3\ N^{(+)}[CH_2CH(CH_2O(O)CR^1)O(O)CR^1]\ C_1^{(-)}$$

wherein each R is a methyl or ethyl group and preferably each R^1 is in the range of C_{15} to C_{19}. As used herein, when the diester is specified, it can include the monoester that is present. The amount of monoester that can be present is the same as in DEQA (1).

[0083] These types of agents and general methods of making them are disclosed in U.S. Pat. No. 4,137,180, Naik et al., issued Jan. 30, 1979, which is incorporated herein by reference. An example of preferred DEQA (2) is the "propyl" ester quaternary ammonium active having the formula 1,2-di(acyloxy)-3-trimethylammoniopropane chloride, where the acyl is the same as that of FA^1 disclosed hereinafter.

[0084] Some preferred wrinkle compositions of the present invention contain as an essential component from about 0.025% to about 1.0%, preferably from about 0.05% to about 5%, more preferably from about 0.1 % to about 3%, and even more preferably from about 0.2% to about 2% by weight of the composition, of quaternary ammonium active having the formula:

characterized in that said condensation product has an acid value, measured by titration of the condensation product with a standard KOH solution against a phenolphthalein indicator, of less than about 6.5.

[0091] The acid value is preferably less than or equal to about 5, more preferably less than about 3.

[0092] The acid value is determined by titration of the condensation product with a standard KOH solution against a phenolphthalein indicator according to ISO#53402. The Acid Value (AV) is expressed as mg KOH/g of the condensation product.

[0093] These quaternary ammonium compounds for use herein are typically mixtures of materials. The weight percentages of compounds wherein one (monoester), two (diester), or three (triester) of the triethanolamine hydroxy groups is esterified with a fatty acyl group are as follows: Monoester - from about 12% to about 22%; diester - from about 43% to about 57%; and triester - from about 13% to about 28%. These compounds, as formed and used in the formulation of wrinkle compositions, typically contain from about 6% to about 20% by weight of solvent, e.g., from about 3% to about 10% of a lower molecular alcohol like ethanol and from about 3% to about 10% of solvent that is more hydrophobic, like hexylene glycol.

[0094] Quaternary compounds for use herein can also be mixtures generated by starting with diethanolamine as a starting material. In this case, typical mixtures generated include compounds wherein one (monoester) and two (diester) of the diethanolamine hydroxy groups are esterified with a fatty acyl group as follows: Monoester - from about 5% to about 15%; and diester from about 85% to about 95%. These compounds as formed and used in the formulation of wrinkle compositions, typically contain from about 6% to about 20% by weight of solvent, e.g., from about 3% to about 20% of lower molecular alcohol like ethanol and/or isopropanol and from about 3% to about 20% of solvent that is more hydrophobic, like hexylene glycol.

[0095] Preferred cationic, preferably biodegradable, quaternary, ammonium compounds can contain the group -(O) CR^1 which is derived from animal fats, unsaturated, and polyunsaturated, fatty acids, e.g., oleic acid, and/or partially hydrogenated fatty acids, derived from vegetable oils and/or partially hydrogenated vegetable oils, such as, canola oil, safflower oil, peanut oil, sunflower oil, corn oil, soybean oil, tall oil, rice bran oil, etc. Non-limiting examples of fatty acids (FA) are listed in U.S. Pat. No. 5,759,990 at column 4, lines 45-66.

[0096] Mixtures of fatty acids, and mixtures of FAs that are derived from different fatty acids can be used, and are preferred. Nonlimiting examples of FA's that can be blended, to form FA's of this invention are as follows:

Fatty Acyl Group	FA^1	FA^2	FA^3
C_{14}	0	0	1
C_{16}	3	11	25
C_{18}	3	4	20
C14:1	0	0	0
C16:1	1	1	0
C18:1	79	27	45
C18:2	13	50	6
C18:3	1	7	0
Unknowns	0	0	3
Total	100	100	100
IV	99	125-138	56
cis/trans (C18:1)	5-6	Not Available	7
TPU	14	57	6

[0097] FA^1 is a partially hydrogenated fatty acid prepared from canola oil, FA^2 is a fatty acid prepared from soy bean oil, and FA^3 is a slightly hydrogenated tallow fatty acid.

[0098] Preferred quaternary ammonium actives contain an effective amount of molecules containing two ester linked hydrophobic groups [R^1 C(CO)O-], said actives being referred to herein as "DEQA's", are those that are prepared as a single DEQA from blends of all the different fatty acids that are represented (total fatty acid blend), rather than from blends of mixtures of separate finished DEQA's that are prepared from different portions of the total fatty acid blend.

[0099] It is preferred that at least a majority of the fatty acyl groups are unsaturated, e.g., from about 50% to 100%, preferably from about 55% to about 99%, more preferably from about 60% to about 98%, and that the total level of active containing polyunsaturated fatty acyl groups (TPU) be preferably from 0% to about 30%. The cis/trans ratio for the unsaturated fatty acyl groups is usually important, with the cis/trans ratio being from about 1:1 to about 50:1, the minimum being about 1:1, preferably at least about 3:1, and more preferably from about 4:1 to about 20:1. (As used herein, the "percent of quaternary ammonium active" containing a given R^1 group is the same as the percentage of that same R^1

[0110] The above processes produce a quaternary ammonium active with reduced coloration and malodor.

Other Quaternary Ammonium Actives

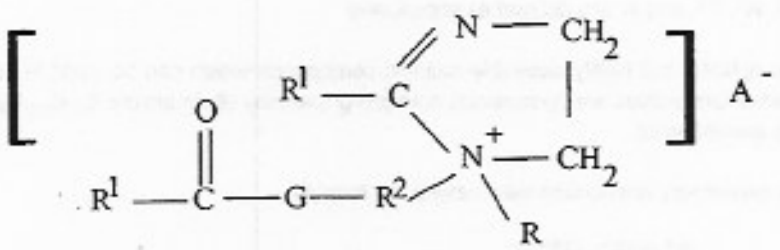
[0111] Other less preferred quaternary ammonium actives include, but are not limited to, those disclosed hereinafter. When quaternary ammonium compounds are include in the wrinkle composition, these less preferred quaternary ammonium actives can be present in minor amounts, either alone, or as part of the total amount of quaternary ammonium in the said composition, said other fabric quaternary ammonium active being selected from:

(1) quaternary ammonium having the formula:

$$[R_{4-m} - N^{(+)} - R^1{}_m] \quad A^-$$

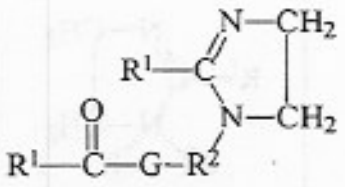
wherein each m is 2 or 3, each R^1 is a C_8-C_{22}, preferably C_{14}-C_{20}, but no more than one being less than about C_{12} and then the other is at least about 16, hydrocarbyl, or substituted hydrocarbyl substituent, preferably C_{10}-C_{20} alkyl or alkenyl (unsaturated alkyl, including polyunsaturated alkyl, also referred to sometimes as "alkylene"), most preferably C_{12}-C_{18} alkyl or alkenyl, and where the Iodine Value (hereinafter referred to as "IV") of a fatty acid containing this R^1 group is from about 70 to about 140, more preferably from about 80 to about 130; and most preferably from about 90 to about 115 (as used herein, the term "Iodine Value" means the Iodine Value of a "parent" fatty acid, or "corresponding" fatty acid, which is used to define a level of unsaturation for an R^1 group that is the same as the level of unsaturation that would be present in a fatty acid containing the same R^1 group) with, preferably, a cis/trans ratio of from about 1:1 to about 50:1, the minimum being 1:1, preferably from about 2:1 to about 40:1, more preferably from about 3:1 to about 30:1, and even more preferably from about 4:1 to about 20:1; less preferred, but still suitable for these wrinkle compositions are quaternary ammonium compounds with an IV as low as 10; each R^1 can also preferably be a branched chain C_{14}-C_{22} alkyl group, preferably a branched chain C_{16}-C_{18} group; each R is H or a short chain C_1-C_6, preferably C_1-C_3 alkyl or hydroxyalkyl group, e.g., methyl (most preferred), ethyl, propyl, hydroxyethyl, and the like, benzyl, or $(R^2\,O)_{2-4}H$ where each R^2 is a C_{1-6} alkylene group; and A^- is a quaternary ammonium compatible anion, preferably, chloride, bromide, methylsulfate, ethylsulfate, sulfate, and nitrate, more preferably chloride and methyl sulfate;

(2) quaternary ammonium having the formula:



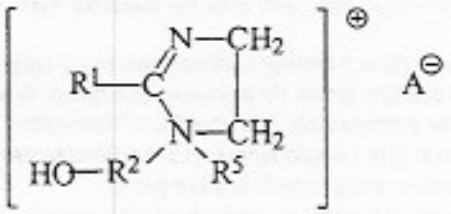
wherein each R, R^1, and A^- have the definitions given above; each R^2 is a C_{1-6} alkylene group, preferably an ethylene group; and G is an oxygen atom or an -NR- group;

(3) active having the formula:



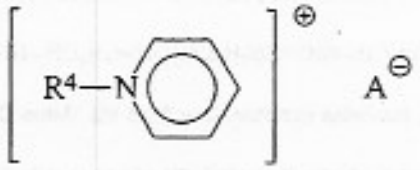
wherein R^1, R^2 and G are defined as above;

(10) substituted imidazolinium salts having the formula:



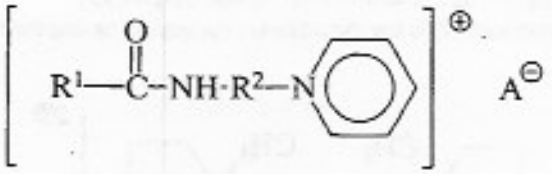
wherein R^5 is a C_1-C_4 alkyl or hydroxyalkyl group, and R^1, R^2, and A^- are as defined above;

(11) alkylpyridinium salts having the formula:



wherein R^4 is an acyclic aliphatic C_6-C_{22} hydrocarbon group and A^- is an anion; and

(12) alkanamide alkylene pyridinium salts having the formula:



wherein R^1, R^2 and A^- are defined as herein below; and mixtures thereof.

[0113] Examples of Compound (8) are the monoalkenyltrimethylammonium salts such as monooleyltrimethylammonium chloride, monocanolatrimethylammonium chloride, and soyatrimethylammonium chloride. Monooleyltrimethylammonium chloride and monocanolatrimethylammonium chloride are preferred. Other examples of Compound (8) are soyatrimethylammonium chloride available from Witco Corporation under the trade name Adogen® 415, erucyltrimethylammonium chloride wherein R^1 is a C_{22} hydrocarbon group derived from a natural source; soyadimethylethylammonium ethylsulfate wherein R^1 is a C_{16}-C_{18} hydrocarbon group, R^5 is a methyl group, R^6 is an ethyl group, and A^- is an ethylsulfate anion; and methyl bis(2-hydroxyethyl)oleylammonium chloride wherein R^1 is a C_{18} hydrocarbon group, R^5 is a 2-hydroxyethyl group and R^6 is a methyl group.

[0114] Additional actives that can be used herein are disclosed, at least generically for the basic structures, in U.S. Pat. Nos. 3,861,870, Edwards and Diehl; 4,308,151, Cambre; 3,886,075, Bernardino; 4,233,164, Davis; 4,401,578, Verbruggen; 3,974,076, Wiersema and Rieke; and 4,237,016, Rudkin, Clint, and Young, all of said patents being incorporated herein by reference. The additional actives herein are preferably those that are highly unsaturated versions of the traditional quaternary ammonium actives, i.e., dilong chain alkyl nitrogen derivatives, normally cationic materials, such as dioleyldimethylammonium chloride and imidazolinium compounds as described hereinafter. Examples of more biodegradable fabric quaternary ammonium actives can be found in U.S. Pat. Nos. 3,408,361, Mannheimer, issued Oct. 29, 1968; 4,709,045, Kubo et al., issued Nov. 24, 1987; 4,233,451, Pracht et al., issued Nov. 11, 1980; 4,127,489, Pracht et al., issued Nov. 28, 1979; 3,689,424, Berg et al., issued Sept. 5, 1972; 4,128,485, Baumann et al., issued Dec. 5, 1978; 4,161,604, Elster et al., issued July 17, 1979; 4,189,593, Wechsler et al., issued Feb. 19, 1980; and 4,339,391, Hoffman et al., issued July 13, 1982.

[0115] Examples of Compound (1) are dialkylenedimethylammonium salts such as dicanoladimethylammonium chloride, dicanoladimethylammonium methylsulfate, di(partially hydrogenated soybean, cis/trans ratio of about 4:1)dimeth-

including improved softening and handfeel as well as protection and/or restoration of fibers and fabric appearance.

[0127] Polyquaternary amine compounds also act as suitable quaternary compounds to increase fabric (fiber) lubricity and these are diclosed for use herein:

European Patent Application EP 0,803,498, A1, Robert O. Keys and Floyd E. Friedli, filed April 25, 1997;
British Pat. 808,265, issued Jan. 28, 1956 to Arnold Hoffman & Co., Incorporated;
British Pat. 1,161,552, Koebner and Potts, issued Aug. 13, 1969;
DE 4,203,489 Al, Henkel, published Aug. 12, 1993;
EP 0,221,855, Topfl, Heinz, and Jorg, issued Nov. 3, 1986;
EP 0,503,155, Rewo, issued Dec. 20, 1991;
EP 0,507,003, Rewo, issued Dec. 20, 1991
EPA 0,803,498, published October 29, 1997;
French Pat. 2,523,606, Marie-Helene Fraikin, Alan Dillarstone, and Marc Couterau, filed Mar. 22, 1983;
Japanese Pat. 84-273918, Terumi Kawai and Hiroshi Kitamura, 1986;
Japanese Pat. 2-011,545, issued to Kao Corp., Jan. 16, 1990;
U.S. Pat. 3,079,436, Hwa, issued Feb. 26, 1963;
U.S. Pat. 4,418,054, Green et al., issued Nov. 29, 1983;
U.S. Pat. 4,721,512, Topfl, Abel, and Binz, issued Jan. 26, 1988;
U.S. Pat. 4,728,337, Abel, Topfl, and Riehen, issued Mar. 1, 1988;
U.S. Pat. 4,906,413, Topfl and Binz, issued Mar. 6, 1990;
U.S. Pat. 5,194,667, Oxenrider et al., issued Mar. 16, 1993;
U.S. Pat. 5,235,082, Hill and Snow, issued Aug. 10, 1993;
U.S. Pat. 5,670,472, Keys, issued Sep. 23, 1997;
Weirong Miao, Wei Hou, Lie Chen, and Zongshi Li, Studies on Multifunctional Finishing Agents, Riyong Huaxue Gonye, No. 2, pp. 8-10, 1992;
Yokagaku, Vol 41, No. 4 (1992); and
Disinfection, Sterilization, and Preservation, 4th Edition, published 1991 by Lea & Febiger, Chapter 13, pp. 226-30.

(iv) Mixtures Thereof

[0128] A variety of mixtures of soluble silicone compounds, synthetic solid particles, and quaternary ammonium compounds can be used as fabric lubricants in the present compositions.

(b) Shape Retention Polymer

[0129] These polymers can be natural, or synthetic, and can act by forming a film, and/or by providing adhesive properties. E.g., the present invention can optionally use film-forming and/or adhesive polymer to impart shape retention to fabric, particularly clothing. By "adhesive" it is meant that when applied as a solution or a dispersion to a fiber surface and dried, the polymer can attach to the surface. The polymer can form a film on the surface, or when residing between two fibers and in contact with the two fibers, it can bond the two fibers together. Other polymers such as starches can form a film and/or bond the fibers together when the treated fabric is pressed by a hot iron. Such a film will have adhesive strength, cohesive breaking strength, and cohesive breaking strain. Preferably, the composition will be free of such polymers that can cause a deposit to be seen, e.g., starch, for normal use.

[0130] Nonlimiting examples for natural polymers are starches and their derivatives, and chitins and their derivatives. These are normally not preferred.

[0131] The preferred synthetic polymers useful in the present invention are comprised of monomers. Some nonlimiting examples of monomers which can be used to form the synthetic polymers of the present invention include: low molecular weight C_1-C_6 unsaturated organic mono-carboxylic and polycarboxylic acids, such as acrylic acid, methacrylic acid, crotonic acid, maleic acid and its half esters, itaconic acid, and mixtures thereof; esters of said acids with C_1-C_{12} alcohols, such as methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, 2-methyl-1-propanol, 1-pentanol, 2-pentanol, 3-pentanol, 2-methyl-1-butanol, 1-methyl-1-butanol, 3-methyl-1-butanol, 1-methyl-1-pentanol, 2-methyl-1-pentanol, 3-methyl-1-pentanol, t-butanol, cyclohexanol, 2-ethyl-1-butanol, neodecanol, 3-heptanol, benzyl alcohol, 2-octanol, 6-methyl-1-heptanol, 2-ethyl-1-hexanol, 3,5-dimethyl-1-hexanol, 3,5,5-trimethyl-1-hexanol, 1-decanol, 1-dodecanol, and the like, and mixtures thereof. Nonlimiting examples of said esters are methyl acrylate, ethyl acrylate, t-butyl acrylate, methyl methacrylate, hydroxyethyl methacrylate, methoxy ethyl methacrylate, and mixtures thereof; amides and imides of said acids, such as N,N-dimethylacrylamide, N-t-butyl acrylamide, maleimides; low molecular weight unsaturated alcohols such as vinyl alcohol (produced by the hydrolysis of vinyl acetate after polymerization), allyl alcohol; esters of said alcohols with low molecular weight carboxylic acids, such as, vinyl acetate, vinyl propionate; ethers of said alcohols such as methyl

acrylate, ethyl acrylate, t-butyl acrylate; methacrylic C_1-C_{18} alkyl esters, such as methyl methacrylate, 2-ethyl hexyl methacrylate, methoxy ethyl methacrylate; vinyl alcohol esters of carboxylic acids, such as, vinyl acetate, vinyl propionate, vinyl neodecanoate; aromatic vinyls, such as styrene, t-butyl styrene, vinyl toluene; vinyl ethers, such as methyl vinyl ether; vinyl chloride; vinylidene chloride; ethylene, propylene and other unsaturated hydrocarbons; and the like; and mixtures thereof. Some preferred hydrophobic monomers are methyl acrylate, methyl methacrylate, t-butyl acrylate, t-butyl methacrylate, n-butyl acrylate, n-butyl methacrylate, and mixtures thereof.

[0137] Nonlimiting examples of useful hydrophilic monomers are unsaturated organic mono-carboxylic and polycarboxylic acids, such as acrylic acid, methacrylic acid, crotonic acid, maleic acid and its half esters, itaconic acid; unsaturated alcohols, such as vinyl alcohol, allyl alcohol; polar vinyl heterocyclics, such as vinyl pyrrolidone, vinyl caprolactam, vinyl pyridine, vinyl imidazole; vinyl amine; vinyl sulfonate; unsaturated amides, such as acrylamides, e.g., N,N-dimethylacrylamide, N-t-butyl acrylamide; hydroxyethyl methacrylate; dimethylaminoethyl methacrylate; salts of acids and amines listed above; and the like; and mixtures thereof. Some preferred hydrophilic monomers are acrylic acid, methacrylic acid, N,N-dimethyl acrylamide, N,N-dimethyl methacrylamide, N-t-butyl acrylamide, dimethylamino ethyl methacrylate, vinyl pyrrolidone, salts thereof and alkyl quaternized derivatives thereof, and mixtures thereof.

[0138] Non limiting examples of polymers for use in the present invention include the following, where the composition of the copolymer is given as approximate weight percentage of each monomer used in the polymerization reaction used to prepare the polymer: vinyl pyrrolidone/vinyl acetate copolymers (at ratios of up to about 30% by weight of vinyl pyrrolidone); dimethyl acrylamide/ t-butyl acrylate/ethyl hexyl methacrylate copolymer (10/45/45); vinyl pyrrolidone/vinyl acetate/butyl acrylate copolymer (10/78/12 and 10/70/20); vinyl pyrrolidone/vinyl propionate copolymer (5/95); vinyl caprolactam/vinyl acetate copolymer (5/95); acrylic acid/t-butyl acrylate (25/75) and styling resins sold under the trade names Ultrahold CA 8® by Ciba Geigy (ethyl acrylate/ acrylic acid/N-t-butyl acrylamide copolymer); Resyn 28-1310® by National Starch and Luviset CA 66® Luviset CAN® and Luviflex Soft® by BASF (vinyl acetate/crotonic acid copolymer 90/10); Luviset CAP® by BASF (vinyl acetate/vinyl propionate/crotonic acid 50/40/10); Resyn 28-2930® by National Starch (vinyl acetate/vinyl neodecanoate/crotonic acid copolymer), Amerhold DR-25® by Union Carbide (ethyl acrylate/ methacrylic acid/methyl methacrylate/acrylic acid copolymer), and Poligen A® by BASF (polyacrylate dispersion).

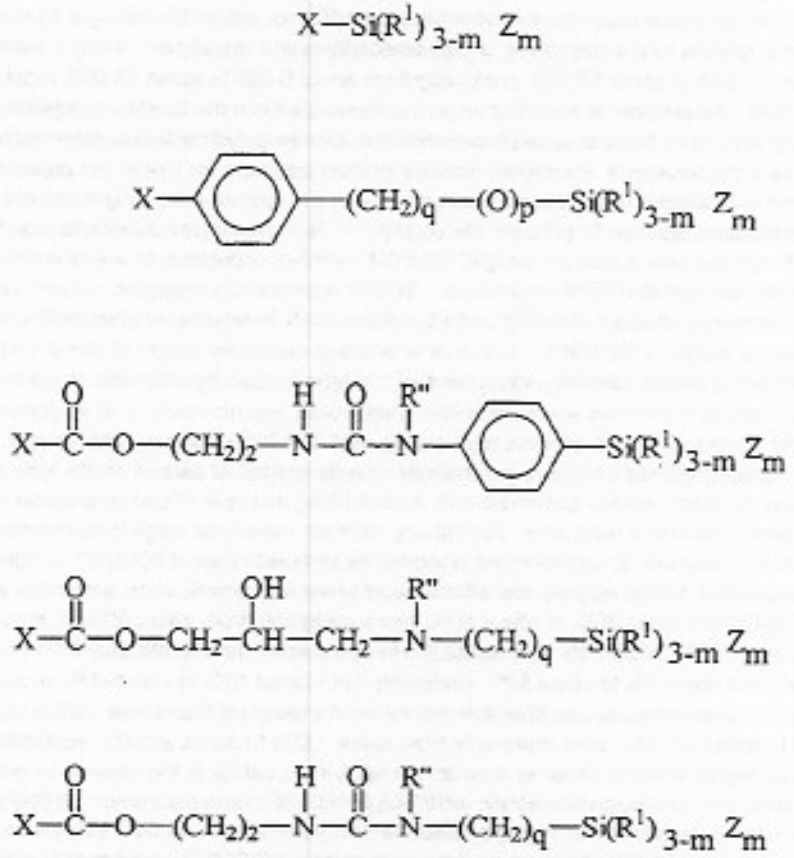
[0139] Preferably, the shape retention polymers contain an effective amount of monomers having carboxylic groups to control amine odor. Highly preferred shape retention copolymers contain hydrophobic monomers and hydrophilic monomers which comprise unsaturated organic mono-carboxylic and polycarboxylic acid monomers, such as acrylic acid, methacrylic acid, crotonic acid, maleic acid and its half esters, itaconic acid, and salts thereof, and mixtures thereof; and optionally other hydrophilic monomers. These preferred polymers of the current invention surprisingly provide control of certain amine type malodors in fabrics, in addition to providing the fabric wrinkle control benefit. Examples of the hydrophilic unsaturated organic mono-carboxylic and polycarboxylic acid monomers are acrylic acid, methacrylic acid, crotonic acid, maleic acid and its half esters, itaconic acid, and mixtures thereof. Nonlimiting examples of the hydrophobic monomers are esters of the unsaturated organic mono-carboxylic and polycarboxylic acids cited hereinabove with C_1-C_{12} alcohols, such as methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, 2-methyl-1-propanol, 1-pentanol, 2-pentanol, 3-pentanol, 2-methyl-1-butanol, 1-methyl-1-butanol, 3-methyl-1-butanol, 1-methyl-1-pentanol, 2-methyl-1-pentanol, 3-methyl-1-pentanol, t-butanol, cyclohexanol, 2-ethyl-1-butanol, and mixtures thereof, preferably methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, 2-methyl-1-propanol, t-butanol, and mixtures thereof. One highly preferred copolymer contains acrylic acid and t-butyl acrylate monomeric units, preferably with acrylic acid/t-butyl, acrylate ratios of from about 90:10 to about 10:90, preferably from about 70:30 to about 15:85, more preferably from about 40:60 to about 20:80. Nonlimiting examples of acrylic acid/tert-butyl acrylate copolymers useful in the present invention are those typically with a molecular weight of from about 1,000 to about 2,000,000, preferably from about 5,000 to about 1,000,000, and more preferably from about 30,000 to about 300,000, and with an approximate acrylic acid/tert-butyl acrylate weight ratio of about 25:75 and an average molecular weight of from about 70,000 to about 100,000, and those with an approximate acrylic acid/tert-butyl acrylate weight ratio of about 35:65 and an average molecular weight of from about 60,000 to about 90,000. Compositions containing these polymers also can additionally comprise perfume, antibacterial active, odor control agent, static control agent, and mixtures thereof.

[0140] The film-forming and/or adhesive polymer of the present invention is present at least an effective amount to provide shape retention, typically from about 0.05% to about 10%, preferably from about 0.1 % to about 5%, more preferably from about 0.2% to about 3%, even more preferably from about 0.3% to about 1.5%, by weight of the usage composition.

[0141] The adhesive polymer is present in the composition in a sufficient amount to result in an amount of from about 0.001% to about 1%, preferably from about 0.01% to about 0.5%, more preferably from about 0.02% to about 0.4% by weight of polymer per weight of dry fabrics.

[0142] It is not intended to exclude the use of higher or lower levels of the polymers, as long as an effective amount is used to provide adhesive and film-forming properties to the composition and the composition can be formulated and effectively applied for its intended purpose.

[0143] Concentrated compositions can also be used in order to provide a less expensive product. When a concentrated



[0153] In these structures m is an integer from 1 to 3, preferably 1; p is 0 or 1; q is an integer from 2 to 6; n is an integer from 0 to 4, preferably 0 or 1, more preferably 0; R^1 is hydrogen, lower alkyl, alkoxy, hydroxyl, aryl, alkylamino, preferably R^1 is alkyl; R" is alkyl or hydrogen; X is

$$CH(R^3)=C(R^4)-$$

R^3 is hydrogen or -COOH, preferably hydrogen; R^4 is hydrogen, methyl or $-CH_2COOH$, preferably methyl; Z is

$$R^5\text{-}[Si(R^6)(R^7)\text{-}O\text{-}]_r$$

wherein R^5, R^6, and R^7, independently are lower alkyl, alkoxy, alkylamino, hydrogen or hydroxyl, preferably alkyl; and r is an integer of from about 5 to about 700, preferably from about 60 to about 400, more preferably from about 100 to about 300. Most preferably, R^5, R^6, and R^7 are methyl, p = 0, and q = 3.

[0154] Silicone-containing adhesive and/or film-forming copolymers useful in the present invention comprise from 0% to about 90%, preferably from about 10% to about 80%, more preferably from about 40% to about 75% of hydrophobic monomer, from about 0% to about 90%, preferably from about 5% to about 80% of hydrophilic monomer, and from about 5% to about 50%, preferably from about 10% to about 40%, more preferably from about 15% to about 25% of silicone-containing monomer.

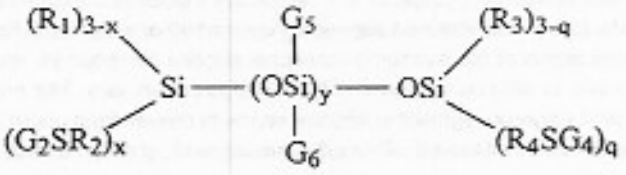
[0155] The composition of any particular copolymer will help determine its formulation properties. In fact, by appropriate selection and combination of particular hydrophobic, hydrophilic and silicone-containing components, the copolymer can be optimized for inclusion in specific vehicles. For example, polymers which are soluble in an aqueous formulation preferably contain from 0% to about 70%, preferably from about 5% to about 70% of hydrophobic monomer, and from about 30% to about 98%, preferably from about 30% to about 80%, of hydrophilic monomer, and from about 1% to about 40% of silicone-containing monomer. Polymers which are dispersible preferably contain from 0% to about 70%, more preferably from about 5% to about 70%, of hydrophobic monomer, and from about 20% to about 80%, more preferably from about 20% to about 60%, of hydrophilic monomer, and from about 1% to about 40% of silicone-containing monomer.

[0163] The non-silicone block, A, comprises monomers selected from the monomers as described hereinabove in reference to the non-silicone hydrophilic and hydrophobic monomers for the silicone grafted copolymers. Vinyl blocks are preferred co-monomers. The block copolymers preferably contain one or more non-silicone blocks, and up to about 50%, preferably from about 10% to about 20%, by weight of one or more polydimethyl siloxane blocks.

(iii) Sulfur-Linked Silicone-Containing Copolymers

[0164] Also useful herein are sulfur-linked silicone containing copolymers, including block copolymers. As used herein in reference to silicone containing copolymers, the term "sulfur-linked" means that the copolymer contains a sulfur linkage (i.e., -S-), a disulfide linkage (i.e., -S-S-), or a sulfhydryl group (i.e.,-SH).

[0165] These sulfur-linked silicone-containing copolymers are represented by the following general formula:



wherein

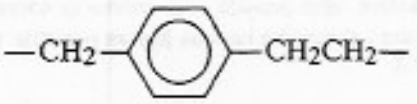
each G_5 and G_6 is independently selected from the group consisting of alkyl, aryl, alkaryl, alkoxy, alkylamino, fluoroalkyl, hydrogen, and -ZSA, wherein A represents a vinyl polymeric segment consisting essentially of polymerized free radically polymerizable monomer, and Z is a divalent linking group (Useful divalent linking groups Z include but are not limited to the following: C_1 to C_{10} alkylene, alkarylene, arylene, and alkoxyalkylene. Preferably, Z is selected from the group consisting of methylene and propylene for reasons of commercial availability.);

each G_2 comprises A;

each G_4 comprises A;

each R_1 is a monovalent moiety selected from the group consisting of alkyl, aryl, alkaryl, alkoxy, alkylamino, fluoroalkyl, hydrogen, and hydroxyl (Preferably, R_1 represents monovalent moieties which can independently be the same or different selected from the group consisting of C_{1-4} alkyl and hydroxyl for reasons of commercial availability. Most preferably, R_1 is methyl.);

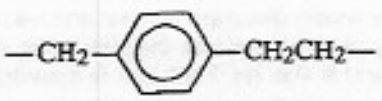
each R_2 is a divalent linking group (Suitable divalent linking groups include but are not limited to the following: C_1 to C_{10} alkylene, arylene, alkarylene, and alkoxyalkylene. Preferably, R_2 is selected from the group consisting of C_{1-3} alkylene and C_7-C_{10} alkarylene due to ease of synthesis of the compound. Most preferably, R_2 is selected from the group consisting of -CH_2-, 1,3-propylene, and



.);

each R_3 represents monovalent moieties which can independently be the same or different and are selected from the group consisting of alkyl, aryl, alkaryl, alkoxy, alkylamino, fluoroalkyl, hydrogen, and hydroxyl (Preferably, R_3 represents monovalent moieties which can independently be the same or different selected from the group consisting of C_{1-4} alkyl and hydroxyl for reasons of commercial availability. Most preferably, R_3 is methyl.);

each R_4 is a divalent linking group(Suitable divalent linking groups include but are not limited to the following: C_1 to C_{10} alkylene, arylene, alkarylene, and alkoxyalkylene. Preferably, R_4 is selected from the group consisting of C_{1-3} alkylene and C_7-C_{10} alkarylene for ease of synthesis. Most preferably, R_4 is selected from the group consisting of -CH_2-, 1,3-propylene, and



.);

(c) Lithium Salts.

[0173] Lithium salts are disclosed as solubilizing aids, e.g., lithium bromide in the production of silk fibroin, (U.S. Pat. No. 4,233,212, issued Nov. 11, 1980 to Otoi et al.), and lithium thiocyanate,(U.S. Pat. No. 5,252,285, issued Oct. 12, 1993 to Robert L. Lock). U.S. Pat. No. 5,296,269, issued Mar. 22, 1994 to Yang et al. discloses a process to produce crease-resistant silk using lithium bromide and lithium chloride. U.S. Pat. No. 5,199,954, issued Apr. 6, 1993 to Schultz et al. discloses a hair dye composition containing lithium bromide. U.S. Pat. No. 5,609,859, issued Mar. 11, 1997 to D. R. Cowsar discloses methods for preparing hair relaxer creams containing a lithium salt. Lithium salts are disclosed as static control agents in a liquid softener composition in U.S. Pat. No. 4,069,159, issued Jan. 17, 1978 to Mason Hayek.

[0174] It is now found that aqueous compositions comprising lithium salts provide improved fabric wrinkle control. Nonlimiting examples of lithium salts that are useful in the present invention are lithium bromide, lithium chloride, lithium lactate, lithium benzoate, lithium acetate, lithium sulfate, lithium tartrate, and/or lithium bitartrate, preferably lithium bromide and/or lithium lactate. Some water soluble salts such as , lithium benzoate are not preferred when the optional cyclodextrin is present because they can form complexes with cyclodextrin. Useful levels of lithium salts are from about 0.1% to about 10%, preferably from about 0.5% to about 7%, more preferably from about 1% to about 5%, by weight of the usage composition.

(d) Hydrophilic Plasticizer

[0175] Optionally, the composition can contain a hydrophilic plasticizer to soften both the fabric fibers, especially cotton fibers, and the adhesive and/or film-forming shape retention polymers. Examples of the preferred hydrophilic plasticizers are short chain low molecular weight polyhydric alcohols, such as is glycerol, ethylene glycol, propylene glycol, diethylene glycol, dipropylene glycol, sorbitol, erythritol or mixtures thereof, more preferably diethylene glycol, dipropylene glycol, ethylene glycol, propylene glycol. Other suitable polyhydric alcohols include: hexylene glycol, 1,2-hexanediol, isopropylene glycol, 1,2-butylene glycol, 2,3-butylene glycol. Mixtures of plasticizers are also suitable for the present invention.. When cyclodextrin is present, the plasticizer should be compatible with it.

[0176] The aqueous compositions containing these plasticizers also tend to provide a slower drying profile for clothing/fabrics, to allow time for any wrinkles to disappear when the clothing/fabrics are hung to dry. This is balanced by the desire by most consumer to have the garments to dry faster. Therefore, when needed, the plasticizers should be used at an effective, but as low as possible, level in the composition. When a hydrophilic plasticizer is used, it is present in the at a level of from 0.01% to 5%, preferably from 0.05% to 2%, more preferably from 0. 1% to 1% by weight of the usage composition.

(e) Mixtures Thereof

[0177] The present compositions can also include supplemental wrinkle control agents comprising a variety of mixtures of fabric (fiber) lubricant, shape retention polymer, lithium salts, and hydrophilic plasticizer.

(2) OPTIONAL ODOR CONTROL AGENT

[0178] The compositions for odor control are of the type disclosed in U.S. Pats. 5,534,165; 5,578,563; 5,663,134; 5,668,097; 5,670,475; and 5,714,137, Trinh et al. issued Jul. 9, 1996; Nov. 26, 1996; Sep. 2, 1997; Sep. 16, 1997; Sep. 23, 1997; and Feb. 3, 1998 respectively. Such compositions can contain several different optional odor control agents in addition to the polymers described hereinbefore that can control amine odors.

(a) Cyclodextrin

[0179] As used herein, the term "cyclodextrin" includes any of the known cyclodextrins such as unsubstituted cyclodextrins containing from six to twelve glucose units, especially, alpha-cyclodextrin, beta-cyclodextrin, gamma-cyclodextrin and/or their derivatives and/or mixtures thereof. The alpha-cyclodextrin consists of six glucose units, the beta-cyclodextrin consists of seven glucose units, and the gamma-cyclodextrin consists of eight glucose units arranged in donut-shaped rings. The specific coupling and conformation of the glucose units give the cyclodextrins a rigid, conical molecular structures with hollow interiors of specific volumes. The "lining" of each internal cavity is formed by hydrogen atoms and glycosidic bridging oxygen atoms; therefore, this surface is fairly hydrophobic. The unique shape and physical-chemical properties of the cavity enable the cyclodextrin molecules to absorb (form inclusion complexes with) organic molecules or parts of organic molecules which can fit into the cavity. Many odorous molecules can fit into the cavity including many malodorous molecules and perfume molecules. Therefore, cyclodextrins, and especially mixtures of cyclodextrins with different size cavities, can be used to control odors caused by a broad spectrum of organic odoriferous

from about 0.1 % to about 4%, more preferably from about 0.5% to about 2% by weight of the composition. Compositions with higher concentrations can leave unacceptable visible stains on fabrics as the solution evaporates off of the fabric. This is especially a problem on thin, colored, synthetic fabrics. In order to avoid or minimize the occurrence of fabric staining, it is preferable that the fabric be treated at a level of less than about 5 mg of cyclodextrin per gram of fabric, more preferably less than about 2 mg of cyclodextrin per gram of fabric. The presence of the surfactant can improve appearance by minimizing localized spotting.

[0186] When it is desired to incorporate cyclodextrin into a concentrated product, the cyclodextrin level is typically from about 3% to about 20%, more preferably from about 5% to about 10%, by weight of the concentrated composition, it is preferable to dilute the concentrated composition before treating fabrics in order to avoid staining. The resulting diluted compostion have usage concentrations of cyclodextrin as discussed hereinbefore, e.g., of from about 0.1% to about 5%, by weight of the diluted composition.

Cyclodextrin Preservative

[0187] Optionally, but desirably if cyclodextrin is present, preferably solubilized, water-soluble, antimicrobial preservative can be added to the composition of the present invention if the antimicrobial material is not sufficient to protect the cyclodextrin, or is not present, because cyclodextrin molecules are made up of varying numbers of glucose units which can make them a prime breeding ground for certain microorganisms, especially when in aqueous compositions. This drawback can lead to the problem of storage stability of cyclodextrin solutions for any significant length of time. Contamination by certain microorganisms with subsequent microbial growth can result in an unsightly and/or malodorous solution. Because microbial growth in cyclodextrin solutions is highly objectionable when it occurs, it is highly preferable to include a solubilized, water-soluble, antimicrobial preservative, which is effective for inhibiting and/or regulating microbial growth in order to increase storage stability of the preferably clear, aqueous odor-absorbing solution containing water-soluble cyclodextrin.

[0188] It is preferable to use a broad spectrum preservative, e.g., one that is effective on both bacteria (both gram positive and gram negative) and fungi. A limited spectrum preservative, e.g., one that is only effective on a single group of microorganisms, e.g., fungi, can be used in combination with a broad spectrum preservative or other limited spectrum preservatives with complimentary and/or supplementary activity. A mixture of broad spectrum preservatives can also be used. In some cases where a specific group of microbial contaminants is problematic (such as Gram negatives), aminocarboxylate chelators may be used alone or as potentiators in conjunction with other preservatives. These chelators which include, e.g., ethylenediaminetetraacetic acid (EDTA), hydroxyethylenediaminetriacetic acid, diethylenetriaminepentaacetic acid, and other aminocarboxylate chelators, and mixtures thereof, and their salts, and mixtures thereof, can increase preservative effectiveness against Gram-negative bacteria, especially *Pseudomonas* species.

[0189] Antimicrobial preservatives useful in the present invention include biocidal compounds, i.e., substances that kill microorganisms, or biostatic compounds, i.e., substances that inhibit and/or regulate the growth of microorganisms. Suitable preservatives are disclosed in U.S. Pats. 5,534,165; 5,578,563; 5,663,134; 5,668,097; 5,670,475; and 5,714,137, Trinh et al. issued Jul. 9, 1996; Nov. 26, 1996; Sep. 2, 1997; Sep. 16, 1997; Sep. 23, 1997; and Feb. 3, 1998 respectively. Preferred antimicrobial preservatives are those that are water-soluble and are effective at low levels because the organic preservatives can form inclusion complexes with the cyclodextrin molecules and compete with the malodorous molecules for the cyclodextrin cavities, thus rendering the cyclodextrins ineffective as odor controlling actives. Water-soluble preservatives useful in the present invention are those that have a solubility in water of at least about 0.3 g per 100 ml of water, i.e., greater than about 0.3% at room temperature, preferably greater than about 0.5% at room temperature. These types of preservatives have a lower affinity to the cyclodextrin cavity, at least in the aqueous phase, and are therefore more available to provide antimicrobial activity. Preservatives with a water-solubility of less than about 0.3% and a molecular structure that readily fits into the cyclodextrin cavity, have a greater tendency to form inclusion complexes with the cyclodextrin molecules, thus rendering the preservative less effective to control microbes in the cyclodextrin solution.

[0190] The water-soluble antimicrobial preservative in the present invention is included at an effective amount. The term "effective amount" as herein defined means a level sufficient to prevent spoilage, or prevent growth of inadvertently added microorganisms, for a specific period of time. In other words, the preservative is not being used to kill microorganisms on the surface onto which the composition is deposited in order to eliminate odors produced by microorganisms. Instead, it is preferably being used to prevent spoilage of the cyclodextrin solution in order to increase the shelf-life of the composition. Preferred levels of preservative are from about 0.0001% to about 0.5%, more preferably from about 0.0002% to about 0.2%, most preferably from about 0.0003% to about 0.1 %, by weight of the usage composition.

[0191] In order to reserve most of the cyclodextrins for odor control, the cyclodextrin to preservative molar ratio should be greater than about 5:1, preferably greater than about 10:1, more preferably greater than about 50:1, even more preferably greater than about 100:1.

[0192] The preservative can be any organic preservative material which will not cause damage to fabric appearance,

[0203] When metallic salts are added to the composition of the present invention they are typically present at a level of from about 0.1 % to about 10%, preferably from about 0.2% to about 8%, more preferably from about 0.3% to about 5% by weight of the usage composition.

(d) Soluble Carbonate and/or Bicarbonate Salts

[0204] Water-soluble alkali metal carbonate and/or bicarbonate salts, such as sodium bicarbonate, potassium bicarbonate, potassium carbonate, cesium carbonate, sodium carbonate, and mixtures thereof can be added to the composition of the present invention in order to help to control certain acid-type odors. Preferred salts are sodium carbonate monohydrate, potassium carbonate, sodium bicarbonate, potassium bicarbonate, and mixtures thereof. When these salts are added to the composition of the present invention, they are typically present at a level of from about 0.1% to about 5%, preferably from about 0.2% to about 3%, more preferably from about 0.3% to about 2%, by weight of the composition. When these salts are added to the composition of the present invention it is preferably that incompatible metal salts not be present in the invention. Preferably, when these salts are used the composition should be essentially free of zinc and other incompatible metal ions, e.g., Ca, Fe, Ba, etc. which form water-insoluble salts.

(e) Enzymes

[0205] Enzymes can be used to control certain types of malodor, especially malodor from urine and other types of excretions, including regurgitated materials. Proteases are especially desirable. The activity of commercial enzymes depends very much on the type and purity of the enzyme being considered. Enzymes that are water soluble proteases like pepsin, tripsin, ficin, bromelin, papain, rennin, and mixtures thereof are particularly useful.

[0206] Enzymes are normally incorporated at levels sufficient to provide up to about 5 mg by weight, preferably from about 0.001 mg to about 3 mg, more preferably from about 0.002 mg to about 1 mg, of active enzyme per gram of the aqueous compositions. Stated otherwise, the aqueous compositions herein can comprise from about 0.0001% to about 0.5%, preferably from about 0.001% to about 0.3%, more preferably from about 0.005% to about 0.2% by weight of a commercial enzyme preparation. Protease enzymes are usually present in such commercial preparations at levels sufficient to provide from 0.0005 to 0.1 Anson units (AU) of activity per gram of aqueous composition.

[0207] Nonlimiting examples of suitable, commercially available, water soluble proteases are pepsin, tripsin, ficin, bromelin, papain, rennin, and mixtures thereof. Papain can be isolated, e.g., from papaya latex, and is available commercially in the purified form of up to, e.g., about 80% protein, or cruder, technical grade of much lower activity. Other suitable examples of proteases are the subtilisins which are obtained from particular strains of *B. subtilis* and *B. licheniformis*. Another suitable protease is obtained from a strain of *Bacillus*, having maximum activity throughout the pH range of 8-12, developed and sold by Novo Industries A/S under the registered trade name ESPERASE®. The preparation of this enzyme and analogous enzymes is described in British Patent Specification No. 1,243,784 of Novo. Proteolytic enzymes suitable for removing protein-based stains that are commercially available include those sold under the trade names ALCALASE® and SAVINASE® by Novo Industries A/S (Denmark) and MAXATASE® by International Bio-Synthetics, Inc. (The Netherlands). Other proteases include Protease A (see European Patent Application 130,756, published January 9, 1985); Protease B (see European Patent Application Serial No. 87303761.8, filed April 28, 1987, and European Patent Application 130,756, Bott et al, published January 9, 1985); and proteases made by Genencor International, Inc., according to one or more of the following patents: Caldwell et al, U.S. Patent Nos. 5,185,258, 5,204,015 and 5,244,791.

[0208] A wide range of enzyme materials and means for their incorporation into liquid compositions are also disclosed in U.S. Patent 3,553,139, issued January 5, 1971 to McCarty et al. Enzymes are further disclosed in U.S. Patent 4,101,457, Place et al, issued July 18, 1978, and in U.S. Patent 4,507,219, Hughes, issued March 26, 1985. Other enzyme materials useful for liquid formulations, and their incorporation into such formulations, are disclosed in U.S. Patent 4,261,868, Hora et al, issued April 14, 1981. Enzymes can be stabilized by various techniques, e.g., those disclosed and exemplified in U.S. Patent 3,600,319, issued August 17, 1971 to Gedge, et al., European Patent Application Publication No. 0 199 405, Application No. 86200586.5, published October 29, 1986, Venegas, and in U.S. Patent 3,519,570.

[0209] Enzyme-polyethylene glycol conjugates are also preferred. Such polyethylene glycol (PEG) derivatives of enzymes, wherein the PEG or alkoxy-PEG moieties are coupled to the protein molecule through, e.g., secondary amine linkages. Suitable derivatization decreases immunogenicity, thus minimizes allergic reactions, while still maintaining some enzymatic activity. An example of protease-PEG's is PEG-subtilisin Carlsberg from B. *lichenniformis* coupled to methoxy-PEGs through secondary amine linkage, and is available from Sigma-Aldrich Corp., St. Louis, Missouri.

(f) Zeolites

[0210] When the clarity of the solution is not needed, and the solution is not sprayed on fabrics, other optional odor absorbing materials, e.g., zeolites and/or activated carbon, can also be used. A preferred class of zeolites is characterized

of the perfume is composed of perfume ingredients of the above groups (a) and (b). For these preferred perfumes, the cyclodextrin to perfume weight ratio is typically of from about 2:1 to about 200:1; preferably from about 4:1 to about 100:1, more preferably from about 6:1 to about 50:1, and even more preferably from about 8:1 to about 30:1.

(a) Hydrophilic Perfume Ingredients

[0220] The hydrophilic perfume ingredients are more soluble in water, have less of a tendency to complex with the cyclodextrins, and are more available in the odor absorbing composition than the ingredients of conventional perfumes. The degree of hydrophobicity of a perfume ingredient can be correlated with its octanol/water partition coefficient P. The octanol/water partition coefficient of a perfume ingredient is the ratio between its equilibrium concentration in octanol and in water. A perfume ingredient with a greater partition coefficient P is considered to be more hydrophobic. Conversely, a perfume ingredient with a smaller partition coefficient P is considered to be more hydrophilic. Since the partition coefficients of the perfume ingredients normally have high values, they are more conveniently given in the form of their logarithm to the base 10, logP. Thus the preferred perfume hydrophilic perfume ingredients of this invention have logP of about 3.5 or smaller, preferably of about 3.0 or smaller.

[0221] The logP of many perfume ingredients have been reported; for example, the Pomona92 database, available from Daylight Chemical Information Systems, Inc. (Daylight CIS), Irvine, California, contains many, along with citations to the original literature. However, the logP values are most conveniently calculated by the "CLOGP" program, also available from Daylight CIS. This program also lists experimental logP values when they are available in the Pomona92 database. The "calculated logP" (ClogP) is determined by the fragment approach of Hansch and Leo (cf., A. Leo, in Comprehensive Medicinal Chemistry, Vol. 4, C. Hansch, P. G. Sammens, J. B. Taylor and C. A. Ramsden, Eds., p. 295, Pergamon Press, 1990, incorporated herein by reference). The fragment approach is based on the chemical structure of each perfume ingredient, and takes into account the numbers and types of atoms, the atom connectivity, and chemical bonding. The ClogP values, which are the most reliable and widely used estimates for this physicochemical property, are used instead of the experimental logP values in the selection of perfume ingredients which are useful in the present invention.

[0222] Non-limiting examples of the more preferred hydrophilic perfume ingredients are allyl amyl glycolate, allyl caproate, amyl acetate, amyl propionate, anisic aldehyde, anisyl acetate, anisole, benzaldehyde, benzyl acetate, benzyl acetone, benzyl alcohol, benzyl formate, benzyl iso valerate, benzyl propionate, beta gamma hexenol, calone, camphor gum, laevo-carveol, d-carvone, laevo-carvone, cinnamic alcohol, cinnamyl acetate, cinnamic alcohol, cinnamyl formate, cinnamyl propionate, cis-jasmone, cis-3-hexenyl acetate, coumarin, cuminic alcohol, cuminic aldehyde, Cyclal C, cyclogalbanate, dihydroeuginol, dihydro isojasmonate, dimethyl benzyl carbinol, dimethyl benzyl carbinyl acetate, ethyl acetate, ethyl aceto acetate, ethyl amyl ketone, ethyl anthranilate, ethyl benzoate, ethyl butyrate, ethyl cinnamate, ethyl hexyl ketone, ethyl maltol, ethyl-2-methyl butyrate, ethyl methylphenyl glycidate, ethyl phenyl acetate, ethyl salicylate, ethyl vanillin, eucalyptol, eugenol, eugenyl acetate, eugenyl formate, eugenyl methyl ether, fenchyl alcohol, flor acetate (tricyclo decenyl acetate), fructone, frutene (tricyclo decenyl propionate), geraniol, geranyl oxyacetaldehyde, heliotropin, hexenol, hexenyl acetate, hexyl acetate, hexyl formate, hinokitiol, hydrotropic alcohol, hydroxycitronellal, hydroxycitronellal diethyl acetal, hydroxycitronellol, indole, isoamyl alcohol, iso cyclo citral, isoeugenol, isoeugenyl acetate, isomenthone, isopulegyl acetate, isoquinoline, keone, ligustral, linalool, linalool oxide, linalyl formate, lyral, menthone, methyl acetophenone, methyl amyl ketone, methyl anthranilate, methyl benzoate, methyl benzyl acetate, methyl cinnamate, methyl dihydrojasmonate, methyl eugenol, methyl heptenone, methyl heptine carbonate, methyl heptyl ketone, methyl hexyl ketone, methyl isobutenyl tetrahydropyran, methyl-N-methyl anthranilate, methyl beta naphthyl ketone, methyl phenyl carbinyl acetate, methyl salicylate, nerol, nonalactone, octalactone, octyl alcohol (octanol-2), para-anisic aldehyde, para-cresol, para-cresyl methyl ether, para hydroxy phenyl butanone, para-methoxy acetophenone, para-methyl acetophenone, phenoxy ethanol, phenoxyethyl propionate, phenyl acetaldehyde, phenylacetaldehyde diethyl ether, phenylethyl oxyacetaldehyde, phenyl ethyl acetate, phenyl ethyl alcohol, phenyl ethyl dimethyl carbinol, prenyl acetate, propyl butyrate, pulegone, rose oxide, safrole, terpineol, vanillin, viridine, and mixtures thereof.

[0223] Nonlimiting examples of other preferred hydrophilic perfume ingredients which can be used in perfume compositions of this invention are allyl heptoate, amyl benzoate, anethole, benzophenone, carvacrol, citral, citronellol, citronellyl nitrile, cyclohexyl ethyl acetate, cymal, 4-decenal, dihydro isojasmonate, dihydro myrcenol, ethyl methyl phenyl glycidate, fenchyl acetate, florhydral, gamma-nonalactone, geranyl formate, geranyl nitrile, hexenyl isobutyrate, alpha-ionone, isobornyl acetate, isobutyl benzoate, isononyl alcohol, isomenthol, para-isopropyl phenylacetaldehyde, isopulegol, linalyl acetate, 2-methoxy naphthalene, menthyl acetate, methyl chavicol, musk ketone, beta naphthol methyl ether, neral, nonyl aldehyde, phenyl heptanol, phenyl hexanol, terpinyl acetate, Veratrol, yara-yara, and mixtures thereof.

[0224] The preferred perfume compositions used in the present invention contain at least 4 different hydrophilic perfume ingredients, preferably at least 5 different hydrophilic perfume ingredients, more preferably at least 6 different hydrophilic perfume ingredients, and even more preferably at least 7 different hydrophilic perfume ingredients. Most common perfume ingredients which are derived from natural sources are composed of a multitude of components. When each such

enol, o-Chlorophenol, Methyl o-Chlorophenol, Ethyl o-Chlorophenol, n-Propyl o-Chlorophenol, n-Butyl o-Chlorophenol, n-Amyl o-Chlorophenol, tert-Amyl o-Chlorophenol, n-Hexyl o-Chlorophenol, n-Heptyl o-Chlorophenol, o-Benzyl p-Chlorophenol, o-benzyl-m-methyl p-Chlorophenol, o-Benzyl-m, m-dimethyl p-Chlorophenol, o-Phenylethyl p-Chlorophenol, o-Phenylethyl-m-methyl p-Chlorophenol, 3-Methyl p-Chlorophenol, 3,5-Dimethyl p-Chlorophenol, 6-Ethyl-3-methyl p-Chlorophenol, 6-n-Propyl-3-methyl p-Chlorophenol, 6-iso-Propyl-3-methyl p-Chlorophenol, 2-Ethyl-3,5-dimethyl p-Chlorophenol, 6-sec-Butyl-3-methyl p-Chlorophenol, 2-iso-Propyl-3,5-dimethyl p-Chlorophenol, 6-Diethylmethyl-3-methyl p-Chlorophenol, 6-iso-Propyl-2-ethyl-3-methyl p-Chlorophenol, 2-sec-Amyl-3,5-dimethyl p-Chlorophenol, 2-Diethylmethyl-3,5-dimethyl p-Chlorophenol, 6-sec-Octyl-3-methyl p-Chlorophenol, p-Chloro-m-cresol, p-Bromophenol, Methyl p-Bromophenol, Ethyl p-Bromophenol, n-Propyl p-Bromophenol, n-Butyl p-Bromophenol, n-Amyl p-Bromophenol, sec-Amyl p-Bromophenol, n-Hexyl p-Bromophenol, cyclohexyl p-Bromophenol, o-Bromophenol, tert-Amyl o-Bromophenol, n-Hexyl o-Bromophenol, n-Propyl-m,m-Dimethyl o-Bromophenol, 2-Phenyl Phenol, 4-Chloro-2-methyl phenol, 4-Chloro-3-methyl phenol, 4-Chloro-3,5-dimethyl phenol, 2,4-dichloro-3,5-dimethylphenol, 3,4,5,6-terabromo-2-methylphenol, 5-methyl-2-pentylphenol, 4-isopropyl-3-methylphenol, para-chloro-meta-xylenol (PCMX), 5-Chloro-2-hydroxydiphenylmethane; Resorcinol and its Derivatives including Resorcinol, Methyl Resorcinol, Ethyl Resorcinol, n-Propyl Resorcinol, n-Butyl Resorcinol, n-Amyl Resorcinol, n-Hexyl Resorcinol, n-Heptyl Resorcinol, n-Octyl Resorcinol, n-Nonyl Resorcinol, Phenyl Resorcinol, Benzyl Resorcinol, Phenylethyl Resorcinol, Phenylpropyl Resorcinol, p-Chlorobenzyl Resorcinol, 5-Chloro 2,4-Dihydroxydiphenyl Methane, 4'-Chloro 2,4-Dihydroxydiphenyl Methane, 5-Bromo 2,4-Dihydroxydiphenyl Methane, and 4' -Bromo 2,4-Dihydroxydiphenyl Methane; Bisphenolic Compounds including 2,2'-, methylene bis (4-chlorophenol), 2,2'-methylene bis (3,4,6-trichlorophenol), 2,2'-methylene bis (4-chloro-6-bromophenol), bis (2-hydroxy-3,5-dichlorophenyl) sulphide, and bis (2-hydroxy-5-chlorobenzyl)sulphide; Benzoic Esters including p-Hydroxybenzoic Acid, Methyl p-Hydroxybenzoic Acid, Ethyl p-Hydroxybenzoic Acid, Propyl p-Hydroxybenzoic Acid, and Butyl p-Hydroxybenzoic Acid.

[0229] Another class of antibacterial agents, which are useful in the present invention, are the so-called "natural" antibacterial actives, referred to as natural essential oils. These actives derive their names from their natural occurrence in plants. Typical natural essential oil antibacterial actives include oils of anise, lemon, orange, rosemary, wintergreen, thyme, lavender, cloves, hops, tea tree, citronella, wheat, barley, lemongrass, cedar leaf, cedarwood, cinnamon, fleagrass, geranium, sandalwood, violet, cranberry, eucalyptus, vervain, peppermint, gum benzoin, *Hydastis carradensis, Berberidaceae. daceae, Ratanhiae* and *Curcuma longa*. Also included in this class of natural essential oils are the key chemical components of the plant oils which have been found to provide the antimicrobial benefit. These chemicals include, but are not limited to anethol, catechole, camphene, thymol, eugenol, eucalyptol, ferulic acid, farnesol, hinokitiol, tropolone, limonene, menthol, methyl salicylate, salicylic acid, thymol, terpineol, verbenone, berberine, ratanhiae extract, caryophellene oxide, citric acid, citronellic acid, curcumin, nerolidol, geraniol and benzoic acid.

[0230] Additional active agents are antibacterial metal salts. This class generally includes salts of metals in groups 3b-7b, 8 and 3a-5a. Specifically are the salts of aluminum, zirconium, zinc, silver, gold, copper, lanthanum, tin, mercury, bismuth, selenium, strontium, scandium, yttrium, cerium, praseodymiun, neodymium, promethum, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium and mixtures thereof.

[0231] Preferred antimicrobial agents for use herein are the broad spectrum actives selected from the group consisting of Triclosan, phenoxyisopropanol, phenoxyethanol, PCMX, natural essential oils and their key ingredients, and mixtures thereof. The most preferred antimicrobial active for use in the present invention is Triclosan.

(a) Quaternary Compounds

[0232] A wide range of quaternary compounds can also be used as antimicrobial actives, in conjunction with the preferred surfactants, for compositions of the present invention. Non-limiting examples of useful quaternary compounds include: (1) benzalkonium chlorides and/or substituted benzalkonium chlorides such as commercially available Barquat® (available from Lonza), Maquat® (available from Mason), Variquat® (available from Witco/Sherex), and Hyamine® (available from Lonza); (2) di(C_6-C_{14})alkyl di-short chain (C_{1-4} alkyl and/or hydroxyalkyl) quaternary such as Bardac® products of Lonza. These quaternary compounds contain two relatively short chains, e.g., C_{1-4} alkyl and/or hydroxy alkyl groups and two C_{6-12}, preferably C_{6-10}, and more preferably C_8, alkyl groups,(3) N-(3-chloroallyl) hexaminium chlorides such as Dowicide® and Dowicil® available from Dow; (4) benzethonium chloride such as Hyamine® 1622 from Rohm & Haas; (5) methylbenzethonium chloride represented by Hyamine® 10X supplied by Rohm & Haas, (6) cetylpyridinium chloride such as Cepacol chloride available from of Merrell Labs. Examples of the preferred dialkyl quaternary compounds are didecyl dimethyl ammonium chlorid (Bardac® 2250) di(C_8-C_{12})dialkyl dimethyl ammonium chloride, such as didecyldimethylammonium chloride (Bardac® 22), and dioctyldimethylammonium chloride (Bardac® 2050). Typical concentrations for biocidal effectiveness of these quaternary compounds range from about 0.001% to about 0.8%, preferably from about 0.005% to about 0.3%, more preferably from about 0.01 % to 0.2%, by weight of the usage composition. The

N_5') hexane dihydrochloride; 1,6-di(N_1,N_1'-p-chlorophenyldiguanido-N_5,N_5')-hexane tetrahydrochloride; and mixtures thereof. As stated hereinbefore, the bis biguanide of choice is chlorhexidine its salts, e.g., digluconate, dihydrochloride, diacetate, and mixtures thereof.

[0238] The surfactants, when added to the antimicrobials tend to provide improved antimicrobial action. This is especially true for the siloxane surfactants, and especially when the siloxane surfactants are combined with the chlorhexidine antimicrobial actives.

(5) OPTIONAL AMINOCARBOXYLATE CHELATORS

[0239] Chelators, e.g., ethylenediaminetetraacetic acid (EDTA), hydroxyethylenediaminetriacetic acid, diethylenetriaminepentaacetic acid, and other aminocarboxylate chelators, and mixtures thereof, and their salts, and mixtures thereof, can optionally be used to increase antimicrobial and preservative effectiveness against Gram-negative bacteria, especially Pseudomonas species. Although sensitivity to EDTA and other aminocarboxylate chelators is mainly a characteristic of Pseudomonas species, other bacterial species highly susceptible to chelators include Achromobacter, Alcaligenes, Azotobacter, Escherichia, Salmonella, Spirillum, and Vibrio. Other groups of organisms also show increased sensitivities to these chelators, including fungi and yeasts. Furthermore, aminocarboxylate chelators can help, e.g., maintaining product clarity, protecting fragrance and perfume components, and preventing rancidity and off odors.

[0240] Although these aminocarboxylate chelators may not be potent biocides in their own right, they function as potentiators for improving the performance of other antimicrobials/preservatives in the compositions of the present invention. Aminocarboxylate chelators can potentiate the performance of many of the cationic, anionic, and nonionic antimicrobials/preservatives, phenolic compounds, and isothiazolinones, that are used as antimicrobials/preservatives in the composition of the present invention. Nonlimiting examples of cationic antimicrobials/preservatives potentiated by aminocarboxylate chelators in solutions are chlorhexidine salts (including digluconate, diacetate, and dihydrochloride salts), and Quaternium-15, also known as Dowicil 200, Dowicide Q, Preventol D1, benzalkonium chloride, cetrimonium, myristalkonium chloride, cetylpyridinium chloride, lauryl pyridinium chloride, and the like. Nonlimiting examples of useful anionic antimicrobials/preservatives which are enhanced by aminocarboxylate chelators are sorbic acid and potassium sorbate. Nonlimiting examples of useful nonionic antimicrobials/preservatives which are potentiated by aminocarboxylate chelators are DMDM hydantoin, phenethyl alcohol, monolaurin, imidazolidinyl urea, and Bronopol (2-bromo-2-nitropropane-1,3-diol).

[0241] Examples of useful phenolic antimicrobials/preservatives potentiated by these chelators are chloroxylenol, phenol, tert-butyl hydroxyanisole, salicylic acid, resorcinol, and sodium o-phenyl phenate. Nonlimiting examples of isothiazolinone antimicrobials/preservatives which are enhanced by aminocarboxylate chelators are Kathon®, Proxel® and Promexal®.

[0242] The optional chelators are present in the compositions of this invention at levels of, typically, from about 0.01% to about 0.3%, more preferably from about 0.02% to about 0.1 %, most preferably from about 0.02% to about 0.05% by weight of the usage compositions to provide antimicrobial efficacy in this invention.

[0243] Free, uncomplexed aminocarboxylate chelators are required to potentiate the efficacy of the antimicrobials. Thus, when excess alkaline earth (especially calcium and magnesium) and transitional metals (iron, manganese, copper, and others) are present, free chelators are not available and antimicrobial potentiation is not observed. In the case where significant water hardness or transitional metals are available or where product esthetics require a specified chelator level, higher levels may be required to allow for the availability of free, uncomplexed aminocarboxylate chelators to function as antimicrobial/preservative potentiators.

Other Optional Ingredients

[0244] The composition of the present invention can optionally contain other adjunct odor-controlling materials, chelating agents, additional antistatic agents if more static control is desired, insect and moth repelling agents, colorants, especially bluing agents, anti-clogging agents, antioxidants, and mixtures thereof in addition to the antiwrinkle ingredients, e.g., cyclic silicone molecules. The total level of optional ingredients is low, preferably less than about 5%, more preferably less than about 3%, and even more preferably less than about 2%, by weight of the usage composition. These optional ingredients exclude the other ingredients specifically mentioned hereinbefore. Incorporating adjunct odor-controlling materials can enhance the capacity of the cyclodextrin to control odors as well as broaden the range of odor types and molecule sizes which can be controlled. Such materials include, for example, the metallic salts described hereinbefore, water-soluble cationic and anionic polymers in addition to those already disclosed, zeolites as discussed hereinbefore, water-soluble bicarbonate salts, and mixtures thereof.

(8) OPTIONAL INSECT AND/OR MOTH REPELLING AGENT

[0253] The composition of the present invention can optionally contain an effective amount of insect and/or moth repelling agents. Typical insect and moth repelling agents are pheromones, such as anti-aggregation pheromones, and other natural and/or synthetic ingredients. Preferred insect and moth repellent agents useful in the composition of the present invention are perfume ingredients, such as citronellol, citronellal, citral, linalool, cedar extract, geranium oil, sandalwood oil, 2-(diethylphenoxy)ethanol, 1-dodecene, etc. Other examples of insect and/or moth repellents useful in the composition of the present invention are disclosed in U.S. Pat. Nos. 4,449,987; 4,693,890; 4,696,676; 4,933,371; 5,030,660; 5,196,200; and in "Semio Activity of Flavor and Fragrance Molecules on Various Insect Species", B.D. Mookherjee et al., published in Bioactive Volatile Compounds from Plants, ASC Symposium Series 525, R. Teranishi, R.G. Buttery, and H. Sugisawa, 1993, pp. 35-48.

[0254] When an insect and/or moth repellent is used it is typically present at a level of from about 0.005% to about 3%, by weight of the usage composition.

(9) OPTIONAL COLORANT

[0255] Colorants and dyes, especially bluing agents, can be optionally added to the wrinkle control compositions for visual appeal and performance impression. When colorants are used, they are used at extremely low levels to avoid fabric staining. Preferred colorants for use in the present compositions are highly water-soluble dyes, e.g., Liquitint® dyes available from Milliken Chemical Co. Non-limiting examples of suitable dyes are, Liquitint Blue HP®, Liquitint Blue 65®, Liquitint Patent Blue®, Liquitint Royal Blue®, Liquitint Experimental Yellow 8949-43®, Liquitint Green HMC®, Liquitint Yellow II®, and mixtures thereof, preferably Liquitint Blue HP®, Liquitint Blue 65®, Liquitint Patent Blue®, Liquitint Royal Blue®, Liquitint Experimental Yellow 8949-43®, and mixtures thereof.

(10) OPTIONAL ANTI-CLOGGING AGENT

[0256] Optional anti-clogging agent which enhances the wetting and anti-clogging properties of the composition, especially when starch is present, is chosen from the group of polymeric glycols of alkanes and olefins having from 2 to about 6, preferably 2 carbon atoms. The anti-clogging agent inhibits the formation of "plugs" in the spray nozzle. An example of the preferred anti-clogging agent is polyethylene glycol having an average molecular weight of from about 800 to about 12,000, more preferably from about 1,400 to about 8,000. When used, the anti-clogging agent is present at a level of from about 0.01% to about 1%, preferably from about 0.05% to about 0.5%, more preferably, from about 0.1 % to about 0.3% by weight of the usage composition.

(11) MIXTURES THEREOF

[0257] A variety of mixtures and combinations of optional supplemental wrinkle control agent, optional odor control agent, optional perfume, optional antimicrobial active, optional aminocarboxylate chelator, optional water-soluble polyionic polymer, optional antistatic agent, optional insect repellant, optional colorant, optional anti-clogging agent, can be used in the present silicone emulsion compositions.

(E) CARRIER

[0258] The preferred carrier of the present invention is water. The water which is used can be distilled, deionized, or tap water. Water is the preferred main liquid carrier due to its low cost, availability, safety, and environmental compatibility. Aqueous solutions are preferred for wrinkle control and odor control.

[0259] Water is very useful for fabric wrinkle removal or reduction. Not to be bound by theory, it is believed that water breaks many intrafiber and interfiber hydrogen bonds that keep the fabric in a wrinkle state. It also swells, lubricates and relaxes the fibers to help the wrinkle removal process.

[0260] Water also serves as the liquid carrier for the cyclodextrins, and facilitates the complexation reaction between the cyclodextrin molecules and any malodorous molecules that are on the fabric when it is treated. The dilute aqueous solution also provides the maximum separation of cyclodextrin molecules on the fabric and thereby maximizes the chance that an odor molecule will interact with a cyclodextrin molecule. It has recently also been discovered that water has an unexpected odor controlling effect of its own. It has been discovered that the intensity of the odor generated by some polar, low molecular weight organic amines, acids, and mercaptans is reduced when the odor-contaminated fabrics are treated with an aqueous solution. Not to be bound by theory, it is believed that water solubilizes and depresses the vapor pressure of these polar, low molecular weight organic molecules, thus reducing their odor intensity.

[0261] The level of liquid carrier in the compositions of the present invention is typically greater than about 80%,

to contribute to environmental problems, and are not preferred. When cyclodextrin is present hydrocarbon propellants are not preferred, because they can form complexes with the cyclodextrin molecules thereby reducing the availability of uncomplexed cyclodextrin molecules for odor absorption. Preferred propellants are compressed air, nitrogen, inert gases, carbon dioxide, etc. A more complete description of commercially available aerosol-spray dispensers appears in U.S. Pat. Nos.: 3,436,772, Stebbins, issued April 8, 1969; and 3,600,325, Kaufman et al., issued August 17, 1971.

[0270] Preferably the spray dispenser can be a self-pressurized non-aerosol container having a convoluted liner and an elastomeric sleeve. Said self-pressurized dispenser comprises a liner/sleeve assembly containing a thin, flexible radially expandable convoluted plastic liner of from about 0.010 to about 0.020 inch thick, inside an essentially cylindrical elastomeric sleeve. The liner/sleeve is capable of holding a substantial quantity of wrinkle control composition product and of causing said product to be dispensed. A more complete description of self-pressurized spray dispensers can be found in U.S. Pat. Nos. 5,111,971, Winer, issued May 12, 1992, and 5,232,126, Winer, issued Aug. 3, 1993. Another type of aerosol spray dispenser is one wherein a barrier separates the wrinkle control composition from the propellant (preferably compressed air or nitrogen), as disclosed in U.S. Pat. No. 4,260,110, issued April 7, 1981. Such a dispenser is available from EP Spray Systems, East Hanover, New Jersey.

[0271] More preferably, the spray dispenser is a non-aerosol, manually or non-manually activated, pump-spray dispenser. Said pump-spray dispenser comprises a container and a pump mechanism which securely screws or snaps onto the container. The container comprises a vessel for containing the aqueous wrinkle control composition to be dispensed.

[0272] The pump mechanism comprises a pump chamber of substantially fixed volume, having an opening at the inner end thereof. Within the pump chamber is located a pump stem having a piston on the end thereof disposed for reciprocal motion in the pump chamber. The pump stem has a passageway there through with a dispensing outlet at the outer end of the passageway and an axial inlet port located inwardly thereof.

[0273] The container and the pump mechanism can be constructed of any conventional material employed in fabricating pump-spray dispensers, including, but not limited to: polyethylene; polypropylene; polyethyleneterephthalate; blends of polyethylene, vinyl acetate, and rubber elastomer. A preferred container is made of clear, e.g., polyethylene terephthalate. Other materials can include stainless steel. A more complete disclosure of commercially available dispensing devices appears in: U.S. Pat. Nos.: 4,895,279, Schultz, issued January 23, 1990; 4,735,347, Schultz et al., issued April 5, 1988; and 4,274,560, Carter, issued June 23, 1981.

[0274] Most preferably, the spray dispenser is a manually activated trigger-spray dispenser. Said trigger-spray dispenser comprises a container and a trigger both of which can be constructed of any of the conventional material employed in fabricating trigger-spray dispensers, including, but not limited to: polyethylene; polypropylene; polyacetal; polycarbonate; polyethyleneterephthalate; polyvinyl chloride; polystyrene; blends of polyethylene, vinyl acetate, and rubber elastomer. Other materials can include stainless steel and glass. A preferred container is made of clear, e.g. polyethylene terephthalate. The trigger-spray dispenser does not incorporate a propellant gas into the odor-absorbing composition, and preferably it does not include those that will foam the wrinkle control composition. The trigger-spray dispenser herein is typically one which acts upon a discrete amount of the wrinkle control composition itself, typically by means of a piston or a collapsing bellows that displaces the composition through a nozzle to create a spray of thin liquid. Said trigger-spray dispenser typically comprises a pump chamber having either a piston or bellows which is movable through a limited stroke response to the trigger for varying the volume of said pump chamber. This pump chamber or bellows chamber collects and holds the product for dispensing. The trigger spray dispenser typically has an outlet check valve for blocking communication and flow of fluid through the nozzle and is responsive to the pressure inside the chamber. For the piston type trigger sprayers, as the trigger is compressed, it acts on the fluid in the chamber and the spring, increasing the pressure on the fluid. For the bellows spray dispenser, as the bellows is compressed, the pressure increases on the fluid. The increase in fluid pressure in either trigger spray dispenser acts to open the top outlet check valve. The top valve allows the product to be forced through the swirl chamber and out the nozzle to form a discharge pattern. An adjustable nozzle cap can be used to vary the pattern of the fluid dispensed.

[0275] For the piston spray dispenser, as the trigger is released, the spring acts on the piston to return it to its original position. For the bellows spray dispenser, the bellows acts as the spring to return to its original position. This action causes a vacuum in the chamber. The responding fluid acts to close the outlet valve while opening the inlet valve drawing product up to the chamber from the reservoir.

[0276] A more complete disclosure of commercially available dispensing devices appears in U.S. Pat. Nos. 4,082,223, Nozawa, issued Apr. 4, 1978; 4,161, 288, McKinney, issued Jul. 17, 1985; 4,434,917, Saito et al., issued Mar. 6, 1984; and 4,819,835, Tasaki, issued Apr. 11, 1989; 5,303,867, Peterson, issued Apr. 19, 1994.

[0277] A broad array of trigger sprayers or finger pump sprayers are suitable for use with the compositions of this invention. These are readily available from suppliers such as Calmar, Inc., City of Industry, California; CSI (Continental Sprayers, Inc.), St. Peters, Missouri; Berry Plastics Corp., Evansville, Indiana, a distributor of Guala® sprayers; or Seaquest Dispensing, Cary, Illinois.

[0278] The preferred trigger sprayers are the blue inserted Guala® sprayer, available from Berry Plastics Corp., or the

[0288] Nonlimiting examples of commercially available electrostatic sprayers appears in U.S. Pat. Nos. 5,222,664, Noakes, issued Jun. 29, 1993; 4,962,885, Coffee, issued Oct. 16, 1990; 2,695,002, Miller, issued Nov. 1954; 5,405,090, Greene, issued Apr. 11, 1995; 4,752,034, Kuhn, issued Jun. 21, 1988; 2,989,241, Badger, issued Jun. 1961; all of said patents are incorporated herein by reference. Electrostatic sprayers are readily available from suppliers such as Tae In Tech Co, South Korea and Spectrum, Houston, Texas.

[0289] Nebulizer sprayers impart energy to the aqueous dewrinkling composition via ultrasonic energy supplied via a transducer. This energy results in the aqueous wrinkle control composition to be atomized. Various types of nebulizers include, but are not limited to, heated, ultrasonic, gas, venturi, and refillable nebulizers.

[0290] Nonlimiting examples of commercially available nebulizer sprayers appears in U.S. Pat. Nos. 3,901,443, Mitsui, issued Aug. 26, 1975; 2,847,248, Schmitt, issued Aug. 1958; 5,511,726, Greenspan, issued Apr. 30, 1996; all of said patents are incorporated herein by reference. Nebulizer sprayers are readily available from suppliers such as A&D Engineering, Inc., Milpitas, California (e.g., model A&D Un-231 ultrasonic handy nebulizer) and Amici, Inc., Spring City, Pennsylvania (model: swirler nebulizer).

[0291] The preferred article of manufacture herein comprises a non-manually operated sprayer, such as a battery-powered sprayer, containing the aqueous wrinkle control composition. More preferably the article of manufacture comprises a combination of a non-manually operated sprayer and a separate container of the aqueous wrinkle control composition, to be added to the sprayer before use and/or to be separated for filling/refilling. The separate container can contain an usage composition, or a concentrated composition to be diluted before use, and/or to be used with a diluting sprayer, such as with a liquid aspirated sprayer, as described herein above.

[0292] Also, as described hereinbefore, the separate container should have structure that mates with the rest of the sprayer to ensure a solid fit without leakage, even after motion, impact, etc. and when handled by inexperienced consumers. The sprayer desirably can also have an attachment system that is safe and preferably designed to allow for the liquid container to be replaced by another container that is filled. E.g., the fluid reservoir can be replaced by a filled container. This can minimize problems with filling, including minimizing leakage, if the proper mating and sealing means are present on both the sprayer and the container. Desirably, the sprayer can contain a shroud to ensure proper alignment and/or to permit the use of thinner walls on the replacement container. This minimizes the amount of material to be recycled and/or discarded. The package sealing or mating system can be a threaded closure (sprayer) which replaces the existing closure on the filled and threaded container. A gasket is desirably added to provide additional seal security and minimize leakage. The gasket can be broken by action of the sprayer closure. These threaded sealing systems can be based on industry standards. However, it is highly desirable to use a threaded sealing system that has non-standard dimensions to ensure that the proper sprayer/bottle combination is always used. This helps prevent the use of fluids that are toxic, which could then be dispensed when the sprayer is used for its intended purpose.

[0293] An alternative sealing system can be based on one or more interlocking lugs and channels. Such systems are commonly referred to as "bayonet" systems. Such systems can be made in a variety of configurations, thus better ensuring that the proper replacement fluid is used. For convenience, the locking system can also be one that enables the provision of a "child-proof' cap on the refill bottle. This "lock-and-key" type of system thus provides highly desirable safety features. There are a variety of ways to design such lock and key sealing systems.

[0294] Care must be taken, however, to prevent the system from making the filling and sealing operation too difficult. If desired, the lock and key can be integral to the sealing mechanism. However, for the purpose of ensuring that the correct recharge or refill is used, the interlocking pieces can be separate from the sealing system. E.g., the shroud and the container could be designed for compatibility. In this way, the unique design of the container alone could provide the requisite assurance that the proper recharge/refill is used.

[0295] Examples of threaded closures and bayonet systems can be found in U.S. Pat. 4,781,311, Nov. 1, 1988 (Angular Positioned Trigger Sprayer with Selective Snap-Screw Container Connection, Clorox), U.S. Pat. 5,560,505, Oct. 1, 1996 (Container and Stopper Assembly Locked Together by Relative Rotation and Use Thereof, Cebal SA), and U.S. Pat. 5,725,132, Mar. 10, 1998 (Dispenser with Snap-Fit Container Connection, Centico International).

(B) SUBSTRATE

[0296] Wrinkle controlling compositions can be placed onto or into a substrate that will contain it until time of use. At the time of use, the article of manufacture (composition plus substrate) is placed into a machine or instrument used to change the physical nature and/or appearance of clothes, fabrics, or fibers. Nonlimiting examples of such machines or instruments include commercial clothes dryers, home clothes dryers, or baths used to finish fabrics in commercial fabric mills. The substrate can be any type of container constructed of any materials that adequately encloses the composition and contains it in a stable form until time of use.

[0297] The substrate is also required to release the compostion during use in the machine or instrument. A preferred substrate will release the said composition in a uniform manner over all clothes, fabrics, or fibers in the machine or instrument. A preferred substrate will release the composition in such a way so as to prevent perceptible staining on

[0306] An effective amount of the liquid composition of the present invention is preferably sprayed onto fabrics, particularly clothing. When the composition is sprayed onto fabric, an effective amount should be deposited onto the fabric, with the fabric becoming damp or totally saturated with the composition, at least where the wrinkle exists, typically from about 5% to about 150%, preferably from about 10% to about 100%, more preferably from about 20% to about 75%, by weight of the fabric. The amount of volatile silicone active typically sprayed onto the fabric is from about 0.001% to about 2%, preferably from about 0.01 % to about 0.5%, more preferably from about 0.02% to about 0.2%, by weight of the fabric. Once an effective amount of the composition is sprayed onto the fabric the fabric is optionally, but preferably stretched while still damp. The fabric is typically stretched perpendicular to the wrinkle, where the wrinkle has a clearly defined line. The fabric can also be smoothed by hand after it has been sprayed and is still damp. In some cases, it is acceptable to simply hang the fabric, while still damp on a hanger or clothes line without further manipulation by hand after spraying. The smoothing movement works particularly well on areas of clothing that have an interface sewn into them, or on the hems of clothing. Once the fabric has been sprayed and optionally, but preferably, stretched or smoothed, it is hung until dry or maintained under stress to reduce the reappearance of the wrinkle.

[0307] The compositions of the present invention can also be used as ironing aids. An effective amount of the composition can be sprayed onto fabric and the fabric is ironed at the normal temperature at which it should be ironed. The fabric can either be sprayed with an effective amount of the composition, allowed to dry and then ironed, or sprayed and ironed immediately. In another aspect of the invention, the composition can be poured directly into an iron or other hand-held device for dewrinkling and delivered to the fabric from that device. In a still further aspect of the invention, the composition can be sprayed onto fabrics in an in-home de-wrinkling chamber containing the fabric to be dewrinkled and/or optionally deodorized, thereby providing ease of operation. Conventional personal as well as industrial deodorizing and/or de-wrinkling apparatuses are suitable for use herein. Traditionally, these apparatuses act by a steaming process which effects a relaxation of the fibers. Examples of home dewrinkling chambers include shower stalls. The spraying of the composition or compounds onto the fabrics can then occur within the chamber of the apparatus or before placing the fabrics into the chamber. Again, the spraying means should preferably be capable of providing droplets with a weight average diameter of from about 8 to about 100 μm, preferably from about 10 to about 50 μm. Preferably, the loading of moisture on fabrics made of natural and synthetic fibers is from about 5 to about 25%, more preferably from about 5 to about 10% by weight of the dried fabric. Other conventional steps that can be carried out in the dewrinkling apparatus can be applied such as heating and drying. Preferably, for optimum dewrinkling benefit, the temperature profile inside the chamber ranges from about 40°C to about 80°C, more preferably from about 50°C to about 70°C. The preferred length of the drying cycle is from about 15 to about 60 minutes, more preferably from about 20 to about 45 minutes.

[0308] Distribution from a substrate is achieved by placing the substrate in a machine or instrument intended to modify the physical properties of clothes, fabrics, or fibers. A nonlimiting example of such a machine is a home or commercial clothes dryer. Distribution from the substrate in a clothes dryer is achieved via direct contact with clothes therefore, it is important that the substrate migrate evenly around the drum of the dryer and uniformly contact all the clothes, fabric, or fiber surfaces. To enhance uniform distribution from the substrate in a clothes dryer, it is preferably to run the clothes dryer for at least about 10 minutes.

[0309] Distribution in the dryer can be accomplished by spraying or misting clothes using a variety of spraying or misting equipment, including, but not limited to, all types of sprayers disclosed hereinbefore, as well as other mechanical devices, e.g. paint sprayers, or any dispensing device that may be mounted in a dryer by a user or incorporated by the manufacturer of the dryer.

[0310] The steaming step in the dewrinkling apparatus can also be eliminated while obtaining the benefits, if the composition is maintained within a temperature range from about 22°C (about 72°F) to about 76°C (about 170°F) before spraying.

[0311] The compositions herein are especially useful, when used to treat garments for extending the time before another wash cycle is needed. Such garments include uni forms and other garments which are normally treated in an industrial process, which can be dewrinkled and/or refreshed and the time between treatments extended.

[0312] The presence of the highly preferred surfactant promotes spreading of the solution and the highly preferred antimicrobial active provides improved odor control as well as antimicrobial action, by minimizing the formation of odors. Both the surfactant and the antimicrobial active provide improved performance and the mixture is especially good. When the compositions are applied in the form of the very small particles (droplets), as disclosed hereinbefore, additional benefits are found, since the distribution is even further improved and overall performance is improved.

[0313] Fabrics can be treated with wrinkle controlling compositions in either the dry state or a wet state. For some situations it is preferable to treat garments or fabrics while those garments or fabrics are dry. For instance, if the fabric is already dry and/or in place where removal would be difficult, e.g., if the wrinkle controlling composition will be used to smooth window curtains or shower curtains that are already hanging or bed clothes that are already on the bed, or dry clothes with minor wrinkles that will be worn soon, it is preferable to treat these items in the already dry state. A particularly preferred situation involves dry clothing or fabrics that have wrinkles caused by compression, e.g. stored in tight containers (suitcases, trunks), compressed in tight spaces (closets, cabinets), left for some period of time after the

also contain bends in the fabrics, often termed creases or pleats, that are desireable. Such creases or pleats are often found on the front of pant legs and the sides of sleeves. These can be reinforced while the garment is being shaped to preseve the crease. Creases are reinforced by applying pressure usually by pinching the fabric either with hands or an implement and pulling the crease through the pressure point or by hanging the garment so that it folds at the crease and reinforces it with the pressure of gravity. The fabric should then be laid out flat to dry or hung on a hanger or with some other apparatus such that the fabric will remain smooth while drying. Weights can be attached to critical points on fabrics and garments to aid in maintaining smooth appearance during drying. Depending on the amount of product used to treat the garment and the weight of the garment, the garment should be dried in air for an upper time of less than about 24 hours, preferably less than about 12 hours, more preferably less than about 6 hours, still more preferably less than about 3 hours, and most preferably equal to or less than about 2 hours and the lower limit of drying time is equal to or greater than about 5 minutes, preferably greater than about 10 minutes, more preferably equal to or greater than about 15 minutes, still more preferably greater than or equal to about 30 minutes and most preferably greater than or equal to about 60 minutes. It is preferable to let fabrics that were very wet prior to treating with the wrinkle controlling composition dry for longer periods. It is also preferable to let fabrics that are treated with higher amounts of the wrinkle controlling composition dry for longer periods of time.

[0318] It is preferable to assist the drying, either by heating, or blowing air across the fabric surface, or both. Thus, at times it is desirable to follow the use of wrinkle controlling composition by treating the fabric with an appliance that can help dry the clothes. Nonlimiting examples of such appliances are clothes dryers and hand-held hair dryers. The wrinkle controlling composition, in combination with an appliance, can be used on both dry or wet fabrics. For instance; when clothes are dried in a clothes dryer and then inadvertently left in the clothes dryer or in a laundry basket or piled on some surface or in some container with out folding, both wet and dry clothes can become badly wrinkled. To remedy this situation, the wrinkle controlling composition can be used in combination with a clothes dryer to remove wrinkles from single fabrics or garments as well as batches, or loads, of fabrics and garments. Drying with low-heat or cool air is preferred for fabrics that normally have a tendency to shrink, such as wool, silk, rayon, and the like.

[0319] The wrinkle controlling composition can be delivered to the clothes dryer by many means. The wrinkle controlling composition can be sprayed onto fabrics or garments prior to adding fabrics or garments to the dryer, sprayed on fabrics or garments while the fabrics or garments are in the dryer, poured directly on the batch of garments and fabrics, or poured on one of the fabrics or garments. The wrinkle controlling composition can also be sprayed onto the fabrics in the dryer by a device that is part of the dryer or attached to it. Available substrates can be used to deliver wrinkle controlling composition for instance, but not limited to, cloth diapers, rags, wash clothes, towels, flexible nonwoven sheet or towellete, or sponges. It should also be understood that an available substrate can be a manufactured item suitable for containing the wrinkle controlling composition before delivery to the dryer and suitable for releasing the wrinkle controlling composition after addition of the available substrate plus wrinkle controlling composition to the dryer. When used in combination with available substrates, the desired amount of the wrinkle controlling composition should be poured directly on the substrate (unless it is already contained within the substrate as an article of manufacture) and the substrate plus the wrinkle controlling composition is then placed in the clothes dryer and the dryer is activated. The dryer temperature should be set according to recommendations given by the fabric manufacturer. An available substrate can be chosen such that it has the capacity to contain the desired level of the said wrinkle controlling composition. Alternately, multiple available substrates can be used to deliver the desired amount of wrinkle controlling composition when the amount exceeds the capacity of one available substrate. Also, when the batch or load of fabrics is large either in number and/or weight, it is often desirable to use multiple available substrates in combination with the wrinkle controlling composition to achieve a more uniform distribution of the wrinkle controlling composition during the tumbling of the fabrics in the dryer. When the wrinkle controlling composition is poured on a fabric or substrate for delivery into the clothes dryer, it is preferred that the item used to deliver the wrinkle controlling composition is clean.

[0320] When using the wrinkle controlling composition through the dryer, it is preferred, to use smaller bundle sizes with typical sizes below about 15 lbs (about 6.8 kg), preferably below about 10 lbs (about 4.5 kg), more preferably below about 8 lbs.(about 3.6 kg), even more preferably below about 6 lbs. (about 2.7 kg) and most preferably at or below about 4 lbs. (about 1.8 kg) It is also desirable to arrange the bundle composition such that fabrics in the bundle have similar weights or densities to promote even distribution. It is also desirable for each substrate plus wrinkle controlling composition to have a weight or density similar to the fabrics in the bundle again to facilitate even distribution. Therefore, in cases where larger bundles are treated, it is preferable as stated above to use multiple available substrate plus wrinkle controlling composition. In cases where fabrics that are dry are treated in the dryer vs. fabrics that are wet, while it is acceptable to have one available substrate plus wrinkle controlling composition, it is preferred to have multiple available substrates plus wrinkle controlling composition in order to reduce the weight and/or density of each available substrate plus wrinkle controlling composition in order to make these more similar in weight and/or density to the dry clothes and thereby facilitate good distribution.

[0321] When treating fabrics in the clothes dryer the amount of wrinkle controlling composition used is dependent on the size of the load of fabrics. For a preferred 4 lbs. bundle of fabrics, wrinkle controlling compositions should be used

composition on curtains and bed clothes eliminates the often awkward and time consuming job of trying to iron large, irregular items; a process (e.g. ironing) that often results in accidentally generating even deeper more obvious and harder-to-remove wrinkles, as the user struggles to control both the large, irregularly shaped fabric and the iron. Thus, treating household fabrics as they hang in place with wrinkle controlling composition often minimizes frustration and struggle. It is especially desirable to dispense wrinkle removal compositions from a powered sprayer as disclosed above to further improve the performance and convenience.

[0328] Wrinkle controlling compositions allow a consumer the freedom to purchase a wider array of garments and fabrics e.g. garments and fabrics which are desirable but typically avoided during purchase decisions due to their tendency to wrinkle. Wrinkle controlling compositions change the care situation of these items from an impractical, time consuming, and frustrating process into a practical task; thus maximizing the pleasure inherent in owning such items by minimizing the tedium associated with taking care of them.

[0329] It is preferably to hang the garments to be treated with the wrinkle removal compositions using a swivel clothes hanger. The swivel clothes hanger has a frame that can be rotated around the stem of the hook. A garment hung on said swivel hanger can be oriented in many directions. This facilitates an even and thorough treatment of the garment with the wrinkle composition when using the spray to treat the garments. Additionally, the swivel hanger facilitates inspection and manipulation of the garment and so is generally useful when used together with wrinkle controlling compositions.

IV. TEST METHOD FOR RAPID STABILITY EVALUATION

[0330] Temperature cycling combined with ultra-centrifugation is a useful method for rapidly determining the stability of emulsified compositions (formulations or products). Temperature cycling mimics conditions that products will have to endure in the market place, by exposing the product to low, moderate, and high temperatures over several cycles. Products with acceptable stability will normally survive several cycles of temperature cycling without separating into layers and/or creaming. Products with very good stability will also be able to survive ultra-centrifugation following several cycles of temperature cycling. Ultra-centrifugation, due to the extreme forces it applies to products will force separation or creaming in products faster than normal gravity conditions. Therefore, these techniques provide a rapid method of evaluating products for preferred stability.

[0331] Temperature cycling involves storing product at 120°F (49°C) for at least about 8 hours; then storing the product at 40°F (4°C) for at least about 8 hours; then storing the product at 70°F (21°C) for at least about 8 hours. This is one temperature cycle. For this method a composition is run through at least about four or five temperature cycles and then centrifuged to determine if it separation into layers or creaming occurs.

[0332] Ultra-centrifugation is performed in a Beckman Optima L-70K Ultra-Centrifuge. The compositions are loaded into a Beckman polyallomer centrifuge tubes until the combined weight of each tube and the composition is 13.50 ± 0.02g. Six tubes with equal weights of different compositions are placed in rotor buckets and placed on the rotor. The rotor is placed into the vacuum chamber. The rotor is placed under vacuum and the compositions are spun at 40,000 rpm for 16 hrs at 25°C. At the end of 16 hrs., the tubes are removed and examined for separation of layers or creaming. When separation is detected, the length of the total composition in the tube is measured. The length of the separation is measured from the bottom of the tube to the point where the separation line is obvious. The length from the bottom of the tube to the separation line is divided by the entire length of the composition and this is considered the % separation. If more than one separation is detected, the length of the total number of separations, from the bottom of the tube to the first separation line closest to the top of the tube is measured and then divided by the total length of the composition in the tube and reported as % seperation. Products with preferred stability have 0% separation after temperature cycling and ultra-centrifugation. Examples are given in Table 8.

[0333] All percentages, ratios, and parts herein, in the Specification, Examples, and Claims are by weight and are the normal approximations unless otherwise stated and all references are incorporated by reference.

[0334] The following are examples of the present compositions, methods, and articles.

EXAMPLE I

[0335] The following is a process for making a composition according to the present invention. The composition is made using a batch mixing system. The batch mixing system has variable speed agitation, a stainless steel mix tank, and a pitched multi-blade dual paddle agitator. Tris buffer solution is made first by adding 99.25% deionized water to the main batch tank followed by 0.61% Tris (hydroxymethyl) amino methane and 0.056% HCl while stirring. The main batch tank is held at 100°F from the time the buffer is made and throughout the entire process. The buffer solution is mixed thoroughly, prior to addition of other ingredients. The speed of stirring is typically about 100 rpm. The buffer solution is mixed from one to two hours.

[0336] Separately, a solution is made in a batch premix tank that comprises 1) about 49.75% D5 volatile silicone, 2)

(continued)

Examples	1	2	3	4	5	6
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
Neodol® 23-3	0.5	0.5	0.5	0.5	0.5	0.5
Silwet® L-7602	0.7	--	--	--	--	--
Silwet® L-7622	--	0.5	--	0.7	--	0.8
Silwet® L-7604	--	--	0.5	--	--	--
Silwet® L-7210	--	--	--	0.5	--	--
Silwet® L-7001	--	--	--	--	1.0	--
Silwet® L-7600	--	--	--	--	--	0.4
Tris(1)	0.61	0.61	0.61	0.61	0.61	0.61
HCl	0.053	0.053	0.053	0.053	0.053	0.053
Perfume	0.1	0.1	0.05	0.1	0.03	0.05
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.

(1) Tris refers to tris(hydroxymethyl)aminomethane.

Table 3.

Examples	1	2	3	4	5	6
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
Lithium bromide	3.0	--	2.0	1.0	2.5	--
Lithium lactate	--	3.0	--	--	--	2.0
D5 volatile silicone	0.5	0.25	0.25	0.25	0.5	0.5
Silicone emulsion A(2)	--	2.0	--	1.0	--	--
Silicone emulsion B(3)	--	--	2.0	--	--	--
Neodol 23-3	0.5	0.5	0.5	0.5	0.5	0.5
Silwet® L-7210	0.5	--	--	--	0.1	--
Silwet® L-7602	--	0.1	--	--	0.1	--
Silwet® L-7622	--	--	0:1	0.4	--	--
Tris	0.61	0.61	0.61	0.61	0.61	0.61
HCl	0.053	0.094	0.072	0.025	0.053	0.053
Perfume	0.1	0.03	0.03	0.05	0.03	--
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.

(2) DC-2-5932 silicone microemulsion (25% active) from Dow Corning, with a particle size of about 24 nm, a cationic surfactant system, and a silicone with an internal phase viscosity of about 1,200 cps.
(3) DC-1550 silicone microemulsion (25% active) from Dow Corning, with a particle size of about 50 nm, an anionic/nonionic surfactant system, and a silicone with an internal phase viscosity of about 100,000 cps.

Table 4.

Examples	1	2	3	4	5	6
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
D5 Volatile Silicone	2.5	2.0	1.5	1.0	0.75	0.5
Neodol® 23-3	0.5	0.5	0.5	0.5	0.5	0.5
Silwet® L77	2.0	2.0	1.0	1.0	1.0	1.0
C45 AS(4)	0.1	0.1	0.1	0.1	0.1	0.1

(continued)

Examples	19	20	21	22	23	24
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
D5 Volatile Silicone	2.5	2.0	1.5	1.0	0.75	0.5
Neodol® 23-3	0.5	0.5	0.5	0.5	0.5	0.5
Silwet® L77 (7)	2.0	2.0	1.0	1.0	1.0	1.0
Stepanol® WAC(7)	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Perfume	0.005-0.06	0.005-0.06	0.005-0.06	0.005-0.06	0.005-0.06	0.005-0.06
Tris	0.61	0.61	0.61	0.61	0.61	0.61
HCl	0.02-0.12	0.02-0.12	0.02-0.12	0.02-0.12	0.02-0.12	0.02-0.12
Kathon®	0.003	0.0003	0.003	0.003	0.003	0.003
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.

Examples	25	26	27	28	29	30
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
D5 Volatile Silicone	2.5	2.0	1.5	1.0	0.75	0.5
Neodol® 23-3	0.5	0.5	0.5	0.5	0.5	0.5
Silwet® L77	2.0	2.0	1.0	1.0	1.0	1.0
Lauryl trimethyl ammonium chloride(8)	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Perfume	0.005-0.06	0.005-0.06	0.005-0.06	0.005-0.06	0.005-0.06	0.005-0.06
Tris	0.61	0.61	0.61	0.61	0.61	0.61
HCl	0.02-0.12	0.02-0.12	0.02-0.12	0.02-0.12	0.02-0.12	0.02-0.12
Proxel GXL® (5)	0.01-0.05	0.01-0.05	0.01-0.05	0.01-0.05	0.01-0.05	0.01-0.05
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.

Examples	31	32	33	34	35	36
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
D5 Volatile Silicone	2.5	2.0	1.5	1.0	0.75	0.5
Neodol® 23-3	0.5	0.5	0.5	0.5	0.5	0.5
Silwet® L77	2.0	2.0	1.0	1.0	1.0	1.0

(continued)

Examples	43	44	45	46	47	48
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.

Examples	49	50	51	52	53	54
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
D5 Volatile Silicone	2.5	2.0	1.5	1.0	0.75	0.5
Neodol® 23-3	0.5	0.5	0.5	0.5	0.5	0.5
Silwet® L77	2.0	2.0	1.0	1.0	1.0	1.0
dimethyl hydroxyethyl lauryl ammonium chloride	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Perfume	0.005-0.06	0.005-0.06	0.005-0.06	0.005-0.06	0.005-0.06	0.005-0.06
Tris	1.22	1.22	1.22	1.22	1.22	1.22
HCl	0.04-0.24	0.04-0.24	0.04-0.24	0.04-0.24	0.04-0.24	0.04-0.24
Bardac® 2250	0.01-1.0	0.01-1.0	0.01-1.0	0.01-1.0	0.01-1.0	0.01-1.0
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.

Examples	55	56	57 58	59	60
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%
D5 Volatile Silicone	2.0	2.0	2.0 1.0	0.5	0.5
Neodol® 23-3	0.75	0.25	1.0 0.25	0.5	0.25
Silwet® L77	1.25	2.25	1.0 1.25	0.5	0.5
Stepanol® WAC	0.1	0.2	0.1	0.1	0.1
Perfume	0.025	0.025	0.025	0.025	0.025
Glycine	0.38	0.38	0.38	0.38	0.38
NaOH	0.008-0.034	0.008-0.034	0.008-0.034	0.008-0.034	0.008-0.034
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.

Examples	61	62	63	64	65
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%
D5 Volatile	2.5	2.5	2.5	2.5	2.5

Table 5

Examples	1	2	3	4	5	6
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
D5 Volatile Silicone	2.5	2.5	2.5	2.5	0.5	0.5
Neodol® 23-3	0.5	0.5	1.5	1.5	1.0	1.0
Silwet® L77	2.0	2.0	2.0	1.25	1.0	1.0
Stepanol WAC®	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Perfume (11) Diahold® ME(11)	0.025 0.5	0.025 1.0	0.025 0.5	0.025 1.0	0.025 0.5	0.025 1.0
Tris	0.61	--	0.61	--	0.61	--
HCl	0.02-0.12	--	0.02-0.12	--	0.02-0.12	--
$NaHCO_3$	--	0.21	--	0.21	--	0.21
NaOH	--	0.02-0.091	--	0.02-0.091	--	0.02-0.091
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.

Examples	7	8	9	10	11	12
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
D5 Volatile Silicone	2.0	2.0	1.5	1.0	1.0	0.75
Neodol® 23-3	1.0	1.0	0.5	0.5	0.5	0.3
Dow Corning® Q2-5211	2.0	2.0	1.7	1.25	1.5	1.1
Stepanol® WAC	0.1	0.1	0.2	0.2	0.2	0.2
Perfume	0.025	0.025	0.03	0.025	0.025	0.025
Diahold® ME	0.25	0.5	1.0	1.0	1.5	1.5
Tris	0.61	0.61	--	--	--	--
HCl	0.02-0.12	0.02-0.12	--	--	--	--
Na_2CO_3	--	--	0.26-0.31	0.26-0.31	0.26-0.31	0.26-0.31
$NaHCO_3$	--	--	0.749-0.763	0.749-0.763	0.749-0.763	0.749-0.763
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.

(11). Acrylic acid/tert-butyl acrylate copolymer in which a number of the acrylic acid units have been modified with polydimethyl siloxane (PDMS). The ratio of t-butyl acrylate to acrylic acid to PDMS modified acrylic acid units in the polymer is approximately 3:1:1 with the number of PDMS repeat units being approximately 100 per polymer.

Table 6

Examples	1	2	3	4	5	6
Ingredients	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
D5 Volatile Silicone	2.5	2.0	1.5	1.0	0.75	0.5
Neodol® 23-3	0.5	0.5	0.5	0.5	0.5	0.5
Dow Corning® Q2-5211	2.0	2.0	1.0	1.0	1.0	1.0
Stepanol® WAC	0.1	0.1	-	0.1	-	0.1
TEA Di-ester Quat(12)	0.2	0.3	0.5	0.7	1.0	1.25
Perfume	0.025	0.025	0.025	0.025	0.025	0.025
KH_2PO_4	0.68	0.68	0.68	0.68	0.68	0.68
NaOH	0.027	0.032	0.039	0.027	0.032	0.039

Claims

1. A silicone emulsion composition comprising:

   (a) from 0,025% to 10% by weight of the composition, of silicone oil to control wrinkles ;
   (b) an effective amount to emulsify said silicone oil and reduce surface tension of said composition of a surfactant system comprising a nonionic silicone surfactant, a conventional nonionic surfactant and an ionic surfactant, wherein the weight ratio of the nonionic silicone surfactant to the silicone oil is from 0.01:1 to 3:1, wherein the weight ratio of the conventional nonionic surfactant to the silicone oil is from 0.007:1 to 1.0:1 and wherein the weight ratio of the ionic silicone surfactant to silicone oil is from 0.0001:1 to 0.5:1;
   (c) an effective amount of a buffering system to maintain a pH of said composition to be at least 6 for a period of at least 3 months;
   (d) a carrier;
   (e) optionally, an effective amount to control wrinkles in fabric of a supplemental wrinkle control agent;
   (f) optionally, an effective amount to absorb or reduce malodor of odor control agent;
   (g) optionally, an effective amount to provide olfactory effects of perfume;
   (h) optionally, an effective amount to kill or reduce the growth of microbes of antimicrobial active; and
   (i) optionally, other ingredients selected from the group consisting of adjunct odor-controlling material, chelating agent, antistatic agent, insect repelling agent, colorant, anti-clogging agent, antioxidant, and mixtures thereof.

2. The silicone emulsion composition of Claim 1, wherein said silicone oil is selected from the group consisting of hydrophobic silicones, silicones fluid at room temperature, and mixtures thereof; said surfactant system comprises (a) nonionic silicone surfactant, (b) conventional nonionic surfactant, and (c) ionic surfactant; said buffering system is selected from the group consisting of

   (a) tris(hydroxymethyl)aminomethane and hydrochloric acid;
   (b) borax and hydrochloric acid;
   (c) diethanolamine and hydrochloric acid;
   (d) sodium borate and sodium hydroxide;
   (e) sodium bicarbonate and sodium hydroxide;
   (f) sodium hydrogen phosphate and sodium hydroxide;
   (g) sodium carbonate and sodium bicarbonate;
   (h) boric acid and sodium hydroxide;
   (i) glycine and sodium hydroxide; and
   (j) potassium chloride and sodium hydroxide; and

   wherein said buffering system has a buffering capacity of at least 0.01; and said carrier is water.

3. The silicone emulsion composition of Claim 2, wherein said buffering system has a buffering capacity of at least 0.02.

4. The silicone emulsion composition of Claim 2, wherein said silicone oil is a polydimethylsiloxane; said nonionic silicone surfactant is a polyalkylene oxide polysiloxane; said conventional nonionic surfactant is an alkyl ethoxylated surfactant; said ionic surfactant is an alkyl sulfate; and wherein said composition comprises from 0.005% to 2% antimicrobial active, by weight of said composition.

5. The silicone emulsion composition of Claim 4, wherein said composition comprises from 0.003% to 0.5% perfume.

6. A method of controlling wrinkles in fabric comprising the steps of

   (a) applying an effective amount of a wrinkle controlling composition according to any of Claims 1 to 5 to said fabric to dampen said fabric in an area of at least one wrinkle;
   (b) stretching said fabric, optionally perpendicular to said wrinkle; and/or
   (c) smoothing said fabric using an implement or a hand.

7. The method of Claim 6, wherein said wrinkle controlling composition is applied to said fabric by spraying said wrinkle controlling composition onto said fabric using a non-manually operated sprayer.

8. The method of Claim 7, wherein said wrinkle controlling composition is sprayed onto said fabric using a sweeping

2. Silikonemulsionszusammensetzung nach Anspruch 1, wobei das Silikonöl ausgewählt ist aus der Gruppe, bestehend aus hydrophoben Silikonen, Silikonen, die bei Raumtemperatur fluid sind, und Mischungen davon; wobei das Tensidsystem (a) nichtionisches Silikontensid, (b) herkömmliches nichtionisches Tensid und (c) ionisches Tensid umfasst; das Pufferungssystem ausgewählt ist aus der Gruppe, bestehend aus:

   (a) Tris(hydroxymethyl)aminomethan und Chlorwasserstoffsäure;
   (b) Borax und Chlorwasserstoffsäure;
   (c) Diethanolamin und Chlorwasserstoffsäure;
   (d) Natriumborat und Natriumhydroxid;
   (e) Natriumhydrogencarbonat und Natriumhydroxid;
   (f) Natriumhydrogenphosphat und Natriumhydroxid;
   (g) Natriumcarbonat und Natriumhydrogencarbonat;
   (h) Borsäure und Natriumhydroxid;
   (i) Glycin und Natriumhydroxid; und
   (j) Kaliumchlorid und Natriumhydroxid; und

   wobei das Puffersystem eine Pufferkapazität von mindestens 0,01 aufweist; und
   wobei der Träger Wasser ist.

3. Silikonemulsionszusammensetzung nach Anspruch 2, wobei das Puffersystem eine Pufferkapazität von mindestens 0,02 hat.

4. Silikonemulsionszusammensetzung nach Anspruch 2, wobei das Silikonöl Polydimetylsiloxan ist; das nichtionische Silikontensid ein Polyalkylenoxidpolysiloxan ist; das herkömmliche nichtionische Tensid ein alkylethoxyliertes Tensid ist; das ionische Tensid ein Alkylsulfat ist; und wobei die Zusammensetzung 0,005 % bis 2 % antimikrobiellen Wirkstoff umfasst, bezogen auf das Gewicht der Zusammensetzung.

5. Silikonemulsionszusammensetzung nach Anspruch 4, wobei die Zusammensetzung zu 0,003 % bis 0,5 % Duftstoff umfasst.

6. Verfahren zur Bekämpfung von Knitterfalten in Textilien, welches die folgenden Schritte umfasst:

   (a) Auftragen einer wirksamen Menge einer Knitterschutzzusammensetzung nach einem der Ansprüche 1 bis 5 auf den Stoff, um den Stoff in einem Bereich von mindestens einer Knitterfalte anzufeuchten;
   (b) Strecken des Stoffes, optional senkrecht zu der Knitterfalte; und/oder
   (c) Glätten des Stoffes mittels eines Gegenstands oder einer Hand.

7. Verfahren nach Anspruch 6, wobei die Knitterschutzzusammensetzung auf den Stoff durch Sprühen der Knitterschutzzusammensetzung auf den Stoff mittels eines nichtmanuell betätigten Sprühers aufgetragen wird.

8. Verfahren nach Anspruch 7, wobei die Knitterschutzzusammensetzung mittels einer schweifenden Bewegung auf den Stoff aufgesprüht wird.

9. Verfahren zur Begrenzung von Knitterfalten in Textilien, welches die folgenden Schritte umfasst:

   (a) Auftragen einer wirksamen Menge einer Knitterschutzzusammensetzung nach einem der Ansprüche 1 bis 5 auf den Stoff, um den Stoff anzufeuchten; und
   (b) Erwärmen des Stoffes.

10. Verfahren nach Anspruch 9, wobei die Knitterschutzzusammensetzung mittels eines Sprühspenders auf den Stoff aufgetragen wird und wobei der Stoff mittels eines Wäschetrockners erwärmt wird.

11. Verfahren nach Anspruch 10, wobei der Sprühspender ein nichtmanuell betätigter Sprüher ist.

12. Verfahren zur Begrenzung von Knitterfalten in Textilien, welches die folgenden Schritte umfasst:

   (a) Legen des Stoffes in einen Wäschetrockner;
   (b) Legen eines Substrats, das eine Knitterschutzzusammensetzung nach einem der Ansprüche 1 bis 5 umfasst,

dans lequel ledit système tampon a une capacité de tamponnage d'au moins 0,01; et ledit véhicule est de l'eau.

3. Composition d'émulsion à base de silicone selon la revendication 2, dans laquelle ledit système tampon a une capacité de tamponnage d'au moins 0,02.

4. Composition d'émulsion à base de silicone selon la revendication 2, dans laquelle ladite huile de silicone est un polyoxydiméthylsiloxane ; ledit agent tensioactif de silicone non ionique est un polysiloxane polyalkène oxyde ; ledit agent tensioactif non ionique classique est un agent tensioactif d'éthoxylate d'alkyle ; ledit agent tensioactif ionique est un alkyl sulfate ; et dans laquelle ladite composition comprend de 0,005 % à 2 % d'agent actif antimicrobien, en poids de ladite composition.

5. Composition d'émulsion à base de silicone selon la revendication 4, dans laquelle ladite composition comprend de 0,003 % à 0,5 % de parfum.

6. Procédé de contrôle des plis dans le tissu comprenant les étapes consistant à :

(a) appliquer une quantité efficace d'une composition de contrôle des plis selon l'une quelconque des revendications 1 à 5, sur ledit tissu pour humidifier ledit tissu dans une zone d'au moins un pli ;
(b) étirer ledit tissu, facultativement perpendiculairement audit pli; et/ou
(c) lisser ledit tissu à l'aide d'un instrument ou d'une main.

7. Procédé selon la revendication 6, dans lequel ladite composition de contrôle des plis est appliquée sur ledit tissu en pulvérisant ladite composition de contrôle des plis sur ledit tissu à l'aide d'un pulvérisateur utilisé de manière non manuelle.

8. Procédé selon la revendication 7, dans lequel ladite composition de contrôle des plis est vaporisée sur ledit tissu à l'aide d'un mouvement de balayage.

9. Procédé de contrôle des plis dans le tissu comprenant les étapes consistant à :

(a) appliquer une quantité efficace d'une composition de contrôle des plis selon l'une quelconque des revendications 1 à 5, sur ledit tissu pour humidifier ledit tissu; et
(b) chauffer ledit tissu.

10. Procédé selon la revendication 9, dans lequel ladite composition de contrôle des plis est appliquée sur ledit tissu à l'aide d'un atomiseur et ledit tissu est chauffé à l'aide d'un séchoir pour le linge.

11. Procédé selon la revendication 10, dans lequel ledit atomiseur est un pulvérisateur utilisé de manière non manuelle.

12. Procédé pour contrôler les plis dans le tissu comprenant les étapes consistant à :

(a) placer ledit tissu dans un séchoir pour le linge ;
(b) placer un substrat comprenant une composition de contrôle des plis selon l'une quelconque des revendications 1 à 5, dans ledit séchoir pour le linge; et
(c) sécher et/ou chauffer ledit tissu dans ledit séchoir pour le linge.

13. Procédé pour contrôler les plis dans le tissu comprenant les étapes consistant à :

(a) suspendre ledit tissu sur un cintre pour vêtements articulé comprenant un châssis et un crochet ayant une souche attachée audit châssis ; et
(b) appliquer une composition de contrôle des plis selon l'une quelconque des revendications 1 à 5, sur ledit tissu en pulvérisant ladite composition de contrôle des plis sur ledit tissu tout en faisant tourner ledit châssis dudit cintre pour vêtements articulé sur ladite souche dudit crochet.

14. Article manufacturé pour contrôler les plis dans le tissu comprenant :

(a) un récipient ; et
(b) une composition de contrôle des plis selon l'une quelconque des revendications 1 à 5 ; et