(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 January 2016 (28.01.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/014798 A1

(51) International Patent Classification:
C11D 3/00 (2006.01) *C11D 3/37* (2006.01)

(21) International Application Number:
PCT/US2015/041737

(22) International Filing Date:
23 July 2015 (23.07.2015)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/027,823 23 July 2014 (23.07.2014) US
62/083,931 25 November 2014 (25.11.2014) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

WO 2016/014798 A1

(54) Title: FABRIC AND/OR HOME CARE COMPOSITIONS

(57) Abstract: The present invention relates to fabric and/or home care products that comprise an inverse dispersion comprising at least one cationic polymer and at least one a stabilizing agent as well as at least a tri- and/or polyfunctional crosslinker wherein the stabilizing agent has one or more hydrophobic chains with more than 30 carbon atoms. The polymer is obtainable by polymerizing at least one cationic monomer and optionally at least one nonionic monomer. Furthermore, the present invention relates to a process for manufacturing fabric and/or home care products that comprise such inverse dispersion.

FABRIC AND/OR HOME CARE COMPOSITIONS

FIELD OF THE INVENTION

The present invention relates to fabric and/or home care products that comprise an inverse dispersion.

BACKGROUND OF THE INVENTION

The underlying problem with current fabric and/or home care products is that they do not have required combination of viscosity, stability and active deposition (typically scent or softening) The following patents and patent applications relate to polymers and/or fabric and home care products that comprise polymers: WO 03/102043; EP 1 756 168; WO 2009/019225; WO 2010/078959; WO 2010/079100; US 2008/0312343; EP-A 172 025; EP-A 172 724; EP-A 172 723; US 8211414; WO 2012/072931; and WO 2004/050812. While there has been efforts in this area, Applicants recognized that the source of the problem was the excessive or insufficient crosslinked density of the current deposition polymers. Such crosslinked density resulted in polymers that inhibited the transfer of actives into the polymer if the polymers were to highly crosslinked or, if the polymers were insufficient crosslinked, the polymers caused the fabric and/or home care products that contained such polymers to be unstable and/or to be to thin. Thus what was needed was a fabric and/or home care product that contained a polymer that, through judicious selected of the polymer and the means of introducing the polymer in a fabric and/or home care product, yielded a fabric and/or home care product that had the desired viscosity, stability and active deposition. Such means of introduction are achieved via adding an inverse dispersion that comprises such polymer to a fabric and/or home care product.

SUMMARY OF THE INVENTION

The present invention relates to fabric and/or home care products that comprise an inverse dispersion comprising at least one cationic polymer and at least one a stabilizing agent as well as at least a tri- and/or polyfunctional crosslinker wherein the stabilizing agent has one or more hydrophobic chains with more than 30 carbon atoms. The polymer is obtainable by polymerizing at least one cationic monomer and optionally at least one nonionic monomer. Furthermore, the present invention relates to a process for manufacturing fabric and/or home care products that comprise such inverse dispersion.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

As used herein, the term “fabric and/or home care product” includes, unless otherwise indicated, granular or powder-form all-purpose or "heavy-duty" washing agents, especially cleaning detergents; liquid, gel or paste-form all-purpose washing agents, especially the so-called heavy-duty liquid types; liquid fine-fabric detergents; hand dishwashing agents or light duty dishwashing agents, especially those of the high-foaming type; machine dishwashing agents, including the various tablet, granular, liquid and rinse-aid types for household and institutional use; liquid cleaning and disinfecting agents, including antibacterial hand-wash types, cleaning bars, car or carpet shampoos, bathroom cleaners including toilet bowl cleaners; and metal cleaners, fabric conditioning products including softening and/or freshening that may be in liquid, solid and/or dryer sheet form; as well as cleaning auxiliaries such as bleach additives and "stain-stick" or pre-treat types, substrate-laden products such as dryer added sheets, dry and wetted wipes and pads, nonwoven substrates, and sponges; as well as sprays and mists. All of such products which were applicable may be in standard, concentrated or even highly concentrated form even to the extent that such products may in certain aspect be non-aqueous.

As used herein, articles such as “a”, “an”, and “the” when used in a claim, are understood to mean one or more of what is claimed or described.

Unless otherwise noted, all component or composition levels are in reference to the active level of that component or composition, and are exclusive of impurities, for example, residual solvents or by-products, which may be present in commercially available sources.

As used herein, polyfunctional means more than three functional units.

All percentages and ratios are calculated by weight unless otherwise indicated. All percentages and ratios are calculated based on the total composition unless otherwise indicated.

It should be understood that every maximum numerical limitation given throughout this specification includes every lower numerical limitation, as if such lower numerical limitations were expressly written herein. Every minimum numerical limitation given throughout this specification will include every higher numerical limitation, as if such higher numerical limitations were expressly written herein. Every numerical range given throughout this specification will include every narrower numerical range that falls within such broader numerical range, as if such narrower numerical ranges were all expressly written herein.

Fabric and Home Care Product

In one aspect, a composition comprising an inverse dispersion comprising

i) a cationic polymer obtainable by the polymerization of

a) a cationic monomer and optionally a nonionic monomer (compound A),

b) a trifunctional or polyfunctional monomer (compound B),

c) optionally a chain transfer agent (compound C),

ii) a stabilizing agent, wherein the stabilizing agent has one or more hydrophobic chains with more than 30 carbon atoms,

iii) a non-aqueous carrier

said composition being a fabric and home care product, is disclosed.

In one aspect, said cationic polymer's amount of compound B lies in the range of from 50 ppm to 475 ppm based on the total amount of compounds A to C.

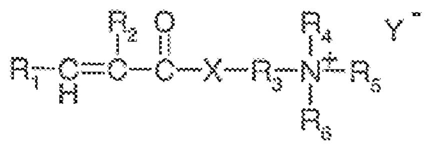
In one aspect, said cationic polymer's compound B is a trifunctional monomer, a tetrafunctional monomer or a mixture thereof.

In one aspect, said cationic polymer's compound B is pentaerythrityl triacrylate, pentaerythrityl tetraacrylate, tetrallylammonium chloride, 1,1,1-trimethylolpropane tri(meth)acrylate, the ethoxylated compounds thereof or a mixture thereof.

In one aspect, said inverse dispersion's stabilizing agent has one or more hydrophobic chains with more than 50 carbon atoms.

In one aspect, said cationic polymer's compound A comprises at least one cationic monomer and at least one nonionic monomer and wherein the weight ratio of cationic monomer to nonionic monomer lies in the range of from 90/10 to 10/90.

In one aspect, said cationic polymer's cationic monomer is selected from a compound of the formula (I)



(I)

where

R_1 is H or $C_1 - C_4$ – alkyl,

R_2 is H or methyl,

R_3 is $C_1 - C_4$ – alkylene,

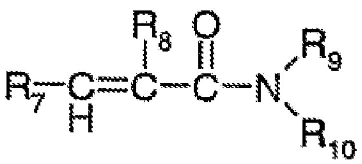
R_4, R_5 and R_6 are each independently H or $C_1 - C_{30}$ – alkyl, $C_1 - C_4$ alkyl alcohol, or C_4 alkoxy alcohol,

X is -O- or -NH- and

Y is Cl; Br; I; hydrogensulfate or methylsulfate.

In one aspect, said cationic polymer's cationic monomer is 2-(Acryloyloxy)ethyl]trimethylammonium chloride.

In one aspect, said cationic polymer's nonionic monomer is selected from N-vinylpyrrolidone, N-vinylimidazole or a compound according to the formula (II)



(II)

where

R_7 is H or C_1–C_4-alkyl,

R_8 is H or methyl, and

R_9 and R_{10}, independently of one another, are H or C_1–C_{30}-alkyl.

In one aspect, said cationic polymer's nonionic monomer is acrylamide.

In one aspect, said cationic polymer's compound C is selected from mercaptans, lactic acid, formic acid, isopropanol or hypophosphites.

In one aspect, said inverse dispersion's stabilizing agent has an ABA block-structure based on polyhydroxystearic acid as A block and polyalkylene oxide as B block.

In one aspect, said composition comprises a fabric and home care ingredient selected from the group consisting of surfactants, builders, chelating agents, dye transfer inhibiting agents, dispersants, enzymes, enzyme stabilizers, catalytic materials, bleach activators, hydrogen peroxide, sources of hydrogen peroxide, preformed peracids, polymeric dispersing agents, clay soil removal/anti-redeposition agents, brighteners, suds suppressors, dyes, hueing dyes, perfumes, perfume delivery systems, structure elasticizing agents, fabric softeners, carriers, structurants, hydrotropes, processing aids, solvents and/or pigments and mixtures thereof, preferably said composition comprises a material selected from the group consisting of fabric softener active, perfume, perfume delivery system, hueing dye, suds suppressor and mixtures thereof, more preferably fabric softener, perfume, perfume delivery system, most preferably said composition comprises a fabric softener.

In one aspect, of said composition said

i) fabric softener active is selected from the group consisting of a quaternary ammonium compound, a silicone polymer, a polysaccharide, a clay, an amine, a fatty ester, a dispersible polyolefin, a polymer latex and mixtures thereof; and

ii) said microcapsules comprises a shell that comprises melamine formaldehyde and/or polyacrylate, preferably said perfume microcapsules comprises a deposition coating, preferably said coating comprises a cationic polymer, preferably said cationic polymer comprise hydrolyzed and/or partially hydrolyzed p polyvinyl formamide.

In one aspect, of said composition, said fabric softener active comprises a material selected from the group consisting of monoesterquats, diesterquats, triesterquats, and mixtures thereof. Preferably, said monoesterquats and diesterquats are selected from the group consisting of bis-(2-hydroxypropyl)-dimethylammonium methylsulfate fatty acid ester and isomers of bis-(2-hydroxypropyl)-dimethylammonium methylsulfate fatty acid ester and/or mixtures thereof, 1,2-di(acyloxy)-3-trimethylammoniopropane chloride, N,N-bis(stearoyl-oxy-ethyl)-N,N-dimethyl ammonium chloride, N,N-bis(tallowoyl-oxy-ethyl)-N,N-dimethyl ammonium chloride, N,N-bis(stearoyl-oxy-ethyl)-N-(2-hydroxyethyl)-N-methyl ammonium methylsulfate, N,N-bis-(stearoyl-2-hydroxypropyl)-N,N-dimethylammonium methylsulfate, N,N-bis-(tallowoyl-2-hydroxypropyl)-N,N-dimethylammonium methylsulphate, N,N-bis-(palmitoyl-2-hydroxypropyl)-N,N-dimethylammonium methylsulfate, N,N-bis-(stearoyl-2-hydroxypropyl)-N,N-dimethylammonium chloride, 1,2-di-(stearoyl-oxy)-3-trimethyl ammoniumpropane chloride, dicanoladimethylammonium chloride, di(hard)tallowdimethylammonium chloride, dicanoladimethylammonium methylsulfate, 1-methyl-1-stearoylamidoethyl-2-stearoylimidazolinium methylsulfate, 1-tallowylamidoethyl-2-tallowylimidazoline, dipalmylmethyl hydroxyethylammoinum methylsulfate and mixtures thereof.

In one aspect, of said composition said fabric softening active has an Iodine Value of between 0-140, preferably 5-100, more preferably 10-80, even more preferably 15-70, even more preferably 18-60, most preferably 18-25. When partially hydrogenated fatty acid quaternary ammonium compound softener is used, the most preferable range is 25-60.

In one aspect the viscosity slope of any of the embodiments of Applicants' compositions that are claimed and/or disclosed is determined using Viscosity Slope Method 1, preferably viscosity slope of any of the embodiments of Applicants' compositions that are claimed and/or disclosed is determined using Viscosity Slope Method 2.

In one aspect, a process of manufacturing of a fabric and home care composition, said process comprising combining an inverse dispersion comprising

i) a cationic polymer obtainable by the polymerization of

a) a cationic monomer and optionally a nonionic monomer (compound A),

b) a trifunctional or polyfunctional monomer (compound B),

c) optionally a chain transfer agent (compound C),

ii) optionally a stabilizing agent, wherein the stabilizing agent has one or more hydrophobic chains with more than 30 carbon atoms,

iii) a one non-aqueous carrier,

wherein the inverse dispersion is obtained by inverse emulsion polymerization, optionally followed by distillation by means of the liquid dispersion polymer technology,

and a fabric and/or home care ingredient, is disclosed.

In one aspect, the use of the inverse dispersion disclosed herein as a thickener in fabric and home care products is disclosed.

In one aspect, a method of thickening a fabric and home care product comprising combining the composition of Claim 1 with one or more fabric and home care product materials.

In one aspect, a method of treating comprising:

i) optionally, washing rinsing and/or drying a fabric and/or surface

ii) treating said fabric and/or surface with a fabric and home care composition disclosed herein; and

iii) optionally, washing rinsing and/or drying a fabric and/or surface is disclosed.

Polymer and Delivery System

The goals of the present specification are achieved by the inverse dispersion according to the invention comprising

i) a cationic polymer obtainable by the polymerization of

a) a cationic monomer and optionally at least one nonionic monomer (compound A),

b) a trifunctional or polyfunctional monomer (compound B),

c) optionally a chain transfer agent (compound C),

ii) a stabilizing agent, wherein the stabilizing agent has one or more hydrophobic chains with more than 30 carbon atoms,

iii) a non-aqueous carrier.

Preferably the crosslinker with more than two reactive groups (compound B) is used in an amount of more than 5 ppm related to the pure polymer and less than 1000 ppm related to the pure polymer, preferably less than 500 ppm related to the pure polymer or more than 5 pphm (parts per hundred monomer) and less than 1000 pphm, preferably less than 500 pphm. The crosslinker with more than two reactive groups (compound B) is used in an amount that the polymer comprises more than 25 % of water soluble polymeric chains, by total weight of the polymer.

The ratio of the stabilizing agent to cationic polymer lies in the range of from 0.1wt% to 20 wt% even more preferably in the range of from 1wt% to 5wt%.

The inverse dispersions according to the invention are characterized in that the dispersions themselves but also the aqueous formulations they are used in have advantageous properties with regard to low coagulum content, high storage stability, deposition, shear dilution, stabilization and/or viscosity (thickening). Low coagulum is understood in the way that during the inverse emulsion polymerisation process but also the final aqueous formulations the dispersions are used in no aggregation between of the ingredients is visible. After the polymerisation process but also the final aqueous formulations the dispersions are used in the same stabilising agent in addition avoids coalescence of the ingredients, which may be induced by thermal motion, Brownian molecular movement or applied shear stress. Therefore the inverse dispersions and the final aqueous formulations have high storage stability even at elevated temperatures and can easily be pumped at higher speed without inducing any visible coagulum or even any sedimentation of the polymer particles in the continuous oil phase. Moreover, they have the advantage that any redispersion required is achieved very quickly. Deposition is understood as meaning the deposition of the active ingredients of, for example, a fabric softener on a fiber during a washing operation. Applied to the present invention, this means that, for example, an inverse dispersion according to the invention comprising at least one cationic polymer (active ingredient) is present in the final aqueous formulations like a fabric softener and the fabric softener is used during or after the washing operation. The inverse dispersions according to the invention promote this deposition of the active ingredient during or after the washing operation to a considerable extent.

When assessing the shear dilution, it is important that the inverse dispersion, after being added to the aqueous formulation like a fabric softener, where the phase inversion from a water in oil to an oil in water system is taking place, in its basic state is viscous and thick whereas it is thin upon stirring. The improved shear dilution has a positive effect on the life and properties of pumps during the production of the aqueous fabric softener, promotes convenient dosage for the consumer and promotes the residue-free use of the fabric softener, especially in the washing machines which have an automatic dosing device. The inverse dispersions according to the invention improve the stability of the thickener per se and that of the corresponding formulation. Also in the aqueous formulation containing the inventive polymer after phase inversion the settling or creaming of additionally added particles like vesicles, different soap phases, microcapsules, aluminium flakes or other particles is effectively prevented, irrespective of whether they are within the order of magnitude of nanometers, micrometers or millimeters. Moreover, they have the advantages that any redispersion required as well as the thickening effect is achieved very quickly.

Embodiments of the present invention in which the cationic polymers present in the inverse dispersion are prepared using little crosslinker is likewise associated with advantages.
Due to the relatively high (water-)soluble components of the polymer, resoiling during a washing operation is reduced. Consequently, the article to be washed, even after repeated washing operations, has clean fibers which have been free effectively of soil particles, such that no graying is detected. Only very slight, if any, adhesion or redistribution of soil particles/polymers on the washed articles is observed, which can then be removed in the next washing cycle avoiding an accumulation effect. Also in that phase of the process the inventive stabilizing agent is apparently supporting the stabilization of the dispersed solid particles, especially with longer hydrophilic B blocks.

A further advantage of the inventive inverse dispersions, in which the cationic polymer is obtained by inverse emulsion polymerization, is manifested in surfactant-containing formulations because a high thickening performance and/or marked shear dilution are achieved in these formulations even at low thickener concentrations (< 1% by weight of inverse dispersion related to the total weight of the formulation).

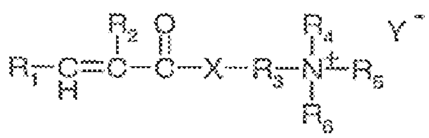
The inventive inverse dispersion comprises, as component i), at least one cationic polymer which is obtainable by the polymerization of compound A and optionally B and C, as compound ii) a stabilizing agent and as compound iii) a non-aqueous carrier.

Compound i): Cationic Polymer

The cationic polymer (compound i), is obtainable by the polymerization of at least one cationic monomer and one trifunctional or polyfunctional monomer. In another preferred embodiment of the present invention, compound i) is obtainable by the polymerization of at least one cationic monomer, at least one nonionic monomer and one trifunctional or polyfunctional monomer. Preferably, the weight ratio of cationic monomer to nonionic monomer lies in the range of from 90/10 to 10/90, more preferably the weight ratio of cationic monomer to nonionic monomer lies in the range of from 75/25 to 40/60 and even mostly preferably in the range of from 60/40 to 50/50.

Compound A

The cationic monomer according to compound A is preferably selected from a compound of formula (I)



(I)

where

R_1 is H or $C_1 - C_4$ – alkyl,

R_2 is H or methyl,

R_3 is $C_1 - C_4$ – alkylene,

R_4, R_5 and R_6 are each independently H or $C_1 - C_{30}$ – alkyl,

X is -O- or -NH- and

Y is Cl; Br; I; hydrogensulfate or methylsulfate.

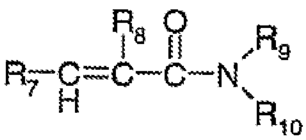
In one embodiment of the present invention, it is preferred that, in the cationic monomer of formula (I),

i) R_1 and R_2 are each H or
ii) R_1 is H and R_2 is CH_3 or preferably also H.

Particularly preferred cationic monomers are [2-(acryloyloxy)ethyl]trimethylammonium chloride also referred to as dimethylaminoethyl acrylate methochloride (DMA3*MeCl) or trimethyl-[2-(2-methylprop-2-enoyloxy)ethyl]azanium chloride also referred as dimethylaminoethyl methacrylate methochloride (DMAEMA*MeCl).

Compound A may comprise at least one nonionic monomer. Apart from the nitrogen-containing monomers described below, such as, for example, the compounds according to formula (II), esters of anionic monomers are suitable as nonionic monomers. Such nonionic monomers are preferably the methyl or ethyl esters of acrylic acid, methacrylic acid, itaconic acid or maleic acid such as ethyl acrylate or methyl acrylate. Additionally preferred are the corresponding dimethylamino-substituted esters such as dimethylaminoethyl (meth)acrylate.

Preferably, the nonionic monomer according to compound A in the cationic polymer is selected from N-vinylpyrrolidone, N-vinylimidazole or a compound according to the formula (II)



(II)

where
R_7 is H or C_1-C_4-alkyl,
R_8 is H or methyl, and
R_9 and R_{10}, independently of one another, are H or C_1-C_{30}-alkyl.

The nonionic monomer is particularly preferably acrylamide, methacrylamide or dialkylaminoacrylamide.

The nonionic monomer may also be an ethylenically unsaturated associative monomer selected from a compound of the following formula

$$R\text{-}O\text{-}(CH_2\text{-}CHR'\text{-}O)_n\text{-}CO\text{-}CR''{=}CH_2$$

where

R is $C_6 - C_{50}$ – alkyl, preferably $C_8 - C_{30}$ – alkyl, especially $C_{16} - C_{22}$– alkyl,

R' is H or $C_1 - C_4$ – alkyl, preferably H,

R" is H or methyl,

n is an integer from 0 to 100, preferably 3 to 50, especially 25.

These compounds can be methacrylates of fatty alcohol ethoxylates.

The R radical in the compounds may also be present as a mixture of radicals with different chain lengths, such as C_{16} and C_{18}. One example thereof is C_{16}-C_{18}-fatty alcohol-(ethylene glycol)$_{25}$-ether methacrylate, where both C_{16} and C_{18} fatty alcohol radicals (in non-negligible amounts) are present as a mixture. In contrast, for example behenyl-25 methacrylate and cetyl-25 methacrylate, the particular R radical is not present as a mixture but as a C_{22} or C_{16} chain. Other chain lengths occur only in the form of impurities. The number "25" in these compounds represents the size of the variables n.

Compound B

Compounds B are preferably crosslinkers having at least three polymerizable groups which can be radically polymerized into the polymer network. Preferably compound B is a trifunctional monomer, a tretrafunctional monomer or a mixture thereof. Suitable crosslinkers are known to the person skilled in the art. Preferably, Compound B is selected from tetraallylammonium chloride; allyl acrylates; allyl methacrylates; and tri- and tetramethacrylates of polyglycols; or polyol polyallyl ethers such as polyallyl sucrose or pentaerythritol triallyl ether, ditrimethylolpropane tetraacrylate, pentaerythrityl tetraacrylate, pentaerythrityl tetramethacrylate, pentaerythrityl triacrylate, pentaerythrityl triacrylate ethoxylate, Triethanolamine trimethacrylate, 1,1,1-trimethylolpropane triacrylate, 1,1,1-trimethylolpropane triacrylate ethoxylate, trimethylolpropane tris(polyethylene glycol ether) triacrylate, 1,1,1-trimethylolpropane trimethacrylate, tris-(2-hydroxyethyl)-1,3,5-triazine-2,4,6-trione triacrylate, tris-(2-

hydroxyethyl)-1,3,5-triazine-2,4,6-trione trimethacrylate, dipentaerythrityl pentaacrylate, 3-(3-{[dimethyl-(vinyl)-silyl]-oxy}-1,1,5,5-tetramethyl-1,5-divinyl-3-trisiloxanyl)-propyl methacrylate, dipentaerythritol hexaacrylate, 1-(2-propenyloxy)-2,2-bis[(2-propenyloxy)-methyl]-butane, trimethacrylic acid-1,3,5-triazin-2,4,6-triyltri-2,1-ethandiyl ester, glycerine triacrylate propoxylate, 1,3,5-triacryloylhexahydro-1,3,5-triazine, 1,3-dimethyl-1,1,3,3-tetravinyldisiloxane, pentaerythrityl tetravinyl ether, 1,3-dimethyl-1,1,3,3-tetravinyldisiloxane, (Ethoxy)-trivinylsilane, (Methyl)-trivinylsilane, 1,1,3,5,5-pentamethyl-1,3,5-trivinyltrisiloxane, 1,3,5-trimethyl-1,3,5-trivinylcyclotrisilazane, 2,4,6-trimethyl-2,4,6-trivinylcyclotrisiloxane, 1,3,5-trimethyl-1,3,5-trivinyltrisilazane, tris-(2-butanone oxime)-vinylsilane, 1,2,4-trivinylcyclohexane, trivinylphosphine, trivinylsilane, methyltriallylsilane, pentaerythrityl triallyl ether, phenyltriallylsilane, triallylamine, triallyl citrate, triallyl phosphate, triallylphosphine, triallyl phosphite, triallylsilane, 1,3,5-triallyl-1,3,5-triazine-2,4,6(1H,3H,5H)-trione, trimellitic acid triallyl ester, trimethallyl isocyanurate, 2,4,6-tris-(allyloxy)-1,3,5-triazine, 1,2-bis-(diallylamino)-ethane, pentaerythrityl tetratallate, 1,3,5,7-tetravinyl-1,3,5,7-tetramethylcyclotetrasiloxane, 1,3,5,7-tetravinyl-1,3,5,7-tetramethylcyclotetrasiloxane, tris-[(2-acryloyloxy)-ethyl]-phosphate, vinylboronic anhydride pyridine, 2,4,6-trivinylcyclotriboroxanepyridine, tetraallylsilane, tetraallyloxysilane, 1,3,5,7-tetramethyl-1,3,5,7-tetravinylcyclotetrasilazane. Compound B is preferably alkyltrimethylammonium chloride, pentaerythrityl triacrylate, pentaerythrityl tetraacrylate, tetrallylammonium chloride, 1,1,1-trimethylolpropane tri(meth)acrylate, or a mixture thereof. These preferred compounds can also be ethoxylated.

Compound C

During the preparation of the polymer by polymerization, at least one chain transfer agent can be used as compound C. Suitable chain transfer agents are known to the person skilled in the art. Compound C is preferably mercaptan, lactic acid, formic acid, isopropanol or hypophosphites.

Preferably, the inventive inverse dispersion comprises at least one cationic polymer obtainable by the polymerization of

a) 20 to 99.99% by weight, preferably 95 to 99.95% by weight (based on the polymer), of compound A,

b) 0.0005% (5ppm) to 0.3% (3000ppm) by weight, preferably from 0.001% to 0.03% by weight, even more preferably 0.0075% to 0.01% by weight of compound B,

c) 0 to 3% by weight, preferably 0.05 to 0.5% by weight (based on the polymer), of at least one chain transfer agent,

in the presence of one stabilizing agent, wherein the stabilizing agent has one or more hydrophobic chains with more than 30 carbon atoms and preferably the weight ratio of stabilizing agent to cationic polymer lies in the range of from 0.1:100 to 10:100, preferably 1:100 to 3:100.

In a further embodiment of the present invention, from 10% to 100% by weight based on the total weight of the cationic polymer are water-soluble polymers, preferably 25% to 50% by weight based on the total weight of the cationic polymer. The solubility of the cationic polymer is determined by methods known to those skilled in the art, by admixing the cationic polymer present in the inventive thickener with a defined amount of water (see, for example, EP-A 343 840 or preferably the determination method of the sedimentation coefficient in the unit of svedberg (sved) according to P. Schuck, 'Size-distribution analysis of macromolecules by sedimentation velocity ultracentrifugation and Lamm equation modeling', Biophysical Journal 78,(3) (2000), 1606-1619).

In a further preferred embodiment of the present invention, from 0% to 90% by weight based on the total weight of the cationic polymer are crosslinked water-swellable polymers, preferably from 50% to 75% by weight based on the total weight of the cationic polymer.
In an especially preferred embodiment of the present invention, the proportion of compound B used in the polymerization of the cationic polymer is less than 1%, preferably less than 0.1% by weight (based on the total amount of compounds A to C) but more than 5 ppm.

Compound ii): Stabilizing agent

The inventive inverse dispersion further comprises, as compound ii), at least one stabilizing agent. Stabilizing agents as such are known in principle to those skilled in the art.

Suitable stabilizing agents are preferably surfactants or polymeric emulsifiers.

Surfactants are for example anionic, nonionic, cationic and/or amphoteric surfactants. Preference is given to using anionic and/or nonionic surfactants, which are disclosed, for example, in US2004/0071716 A1.

In the above mentioned state of the art there are described stabilizing agents with low HLB values to stabilize the dispersed hydrophilic polymer particles in the hydrophobic continuous phase. These agents have a hydrophilic part like mono or oligo-glucoside or the carbon acid containing part of a copolymer and a hydrophobic part like for example alkyl chains with different lengths. The hydrophilic part is dissolved in the hydrophilic polymer particle and the hydrophobic part is concentrated on the surface of the particle and dissolved in the hydrophobic continuous phase forming a “hydrophobic hairy layer” around the hydrophilic cationic polymer particle. Thus the effect of sterical stabilization prevents the destabilization and the coagulation of the hydrophilic particles. The stabilizing effect is as important both during the inverse emulsion polymerization process avoiding larger particles (coagulum) and for the storage stability of the inverse dispersion, avoiding particle sedimentation before it is used in aqueous formulations. The sterical stabilization is especially also effective in high electrolyte containing dispersions or formulations.

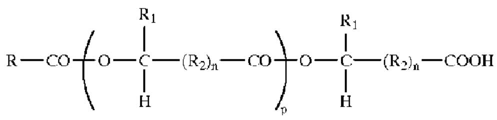
According to the state-of-the-art the length of the hydrophobic part of the emulsifier is not higher than C18 (stearyl-) or sometimes also C22 (behenyl-).

According to this invention it was now experimentally shown that more than 30 carbon atoms, preferably more than 50 carbon atoms containing hydrophobic chains of the stabilizing agent is resulting in a dramatic increase of the stabilizing effect for the hydrophilic polymer particles dispersed in the hydrophobic continuous phase. In general are claimed for that purpose all emulsifiers or polymeric stabilizers containing more than 30 carbon atoms, preferably more than 50 carbon atoms in their hydrophobic chains. Optional this hydrophobic chain can be interrupted after every 6, preferred 10 or more carbon atoms by other atoms like oxygen, nitrogen, sulphur, phosphor or by groups like carbonate, isocyanate, carbamide, esters or others in an amount that they do not essentially disturb the hydrophobic character of the chain in order to get the low HLB-values as described below. Block-, graft- or comb- structure, preferably are based on polyhydroxystearic acid. In the block-structure the AB- or especially ABA-blocks are preferred. In the ABA block-structure the A block is preferably based on polyhydroxystearic acid and the B block on polyalkylene oxide.

It is additionally preferred in the context of the present invention to use a stabilizing surfactant which has a (relatively) low HLB (hydrophilic-lipophilic balance) value. The stabilizing agent preferably has an HLB value of 1 to 12, more preferably of 3 to 9 and especially preferably of 5 to 7.

The preferred concentration of these inventive stabilizing surfactants lies between 0.1 % and 10%, preferably between 1% to 5% by weight related to the total weight of the polymer.

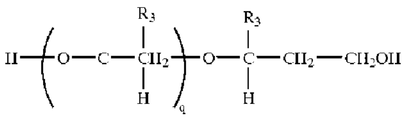
The polymeric emulsifiers are a block copolymers having a general formula A-COO-B-OOC-A, in which B is the divalent residue of a water-soluble polyalkylene glycol and A is the residue of an oil-soluble complex monocarboxylic acid. Such polymeric emulsifiers, as well as the preparation thereof, have been disclosed in GB 2002400 and W09607689, the contents of which are herewith incorporated by reference. The emulsifiers, as described in GB2002400, are emulsifiers wherein A has a molecular weight of at least 500 and is the residue of an oil-soluble complex monocarboxylic acid, i.e. a fatty acid. These complex monocarboxylic acids may be represented by the general formula:



in which

R is hydrogen or a monovalent hydrocarbon or substituted hydrocarbon group;
R1 is hydrogen or a monovalent C1 to C24 hydro- carbon group;
R2 is a divalent C1 to C24 hydrocarbon group;
n is zero or 1;
p is an integer from zero to 200.

The units between the brackets in formula 1 may be all the same or they may differ in respect of R1, R2 and n. The quantity p will not normally have the same unique value for all molecules of the complex acid but will be statistically distributed about an average value lying within the range stated, as is commonplace in polymeric materials. Polymeric component B has a molecular weight of at least 500 and is the divalent residue of a water-soluble polyalkylene glycol having the general formula



wherein

R3 is hydrogen or a C1 to C3 alkyl group;
q is an integer from 10 up to 500.

Most preferred emulsifiers used in the invention are e.g. PEG 30 Dipolyhydroxystearate. Another similar emulsifier for use with the invention are block copolymers (A-B-A) of polyethylene glycol and polyhydroxystearic acid with a mol weight of approximately 5000.
Furthermore the use of these ABA type block copolymers lead to water-in-oil emulsions having excellent stability during storage thus improving the shelf life of said emulsions. The resulting water-in-oil emulsions are stable and fluid at low temperatures, especially at 25° C.

Compound iii): non-aqueous carrier

In the inventive thickener, the cationic polymer may be present dispersed in an oil phase, preferably as an inverse dispersion, water-in-oil dispersion, or as a dispersed anhydrous cationic polymer in oil.

Suitable high boiling oils with boilings points above 220°C are for example, 2-ethylhexyl stearate and hydroheated heavy naphtha, and suitable low-boiling oils with boilings points below 220°C, for example, dearomatized aliphatic hydrocarbons or mineral oils of low viscosity, as defined in WO 2005/097834.

The present invention further provides a process for the manufacture of an inverse dispersion comprising

i) a cationic polymer obtainable by the polymerization of

a) a cationic monomer and optionally a nonionic monomer (compound A),

b) a trifunctional or polyfunctional monomer (compound B),

c) optionally a chain transfer agent (compound C),

ii) at least one stabilizing agent, wherein the stabilizing agent has one or more hydrophobic chains with more than 30 carbon atoms,

iii) at least one non-aqueous carrier,

wherein the inverse dispersion is obtained by inverse emulsion polymerization, optionally followed by distillation by means of the liquid dispersion polymer technology.

In the context of the present invention, the cationic polymer is prepared by inverse emulsion polymerization. Inverse emulsion polymerization is as such known to the person skilled in the art. Inverse emulsion polymerization is understood by the person skilled in the art generally to mean polymerization processes according to the following definition: the hydrophilic monomers are dispersed in a hydrophobic oil phase. The polymerization is effected directly in these hydrophilic monomer particles by addition of initiator.

In addition, it is preferred that, after the inverse emulsion polymerization, at least a portion of water and at least a portion of the low-boiling constituents of the oil phase are distilled off, especially by means of LDP technology (Liquid Dispersion Polymer Technology). LDP technology as such is known to those skilled in the art; it is described, for example, in WO 2005/097834. An inverse dispersion is thus obtained.

The information which follows, unless stated otherwise, applies to all kinds of emulsion polymerization, for example to emulsion polymerization in water, which then constitutes the continuous phase, and especially also to inverse emulsion polymerization in which the hydrophobic oil phase constitutes the continuous phase.

The aqueous phase comprises, for example, a chain transfer agent, a crosslinker, a cationic monomer and optionally an uncharged monomer, and optionally further components. Suitable further components are, for example, complexing agents for salts such as pentasodium diethylenetriaminepentaacetic acid, or compounds which can be used to adjust the pH, such as citric acid.

The oil phase preferably comprises an emulsifier, a stabilizing agent, a high-boiling oil, and a low-boiling oil. In addition, the oil phase may optionally comprise a nonionic monomer or oil-soluble surfactants, activators inducing the phase change during dilution with water, cross-linkers, chain transfer agents or initiator components.

A suitable polymerization initiator is used for the polymerization. Redox initiators and/or thermally activatable free-radical polymerization initiators are preferred.

Suitable thermally activatable free-radical initiators or the oxidative component of the redox initiator pair are in particular those of the peroxy and azo type. These include hydrogen peroxide, peracetic acid, t-butyl hydroperoxide, di-t-butyl peroxide, dibenzoyl peroxide, benzoyl hydroperoxide, 2,4-dichlorobenzoyl peroxide, 2,5-dimethyl-2,5-bis(hydroperoxy)hexane, perbenzoic acid, t-butyl peroxypivalate, t-butyl peracetate, dilauroyl peroxide, dicapryloyl peroxide, distearoyl peroxide, dibenzoyl peroxide, diisopropyl peroxydicarbonate, didecyl peroxydicarbonate, dieicosyl peroxydicarbonate, di-t-butyl perbenzoate, azobisisobutyronitrile, 2,2'-azobis-2,4-dimethylvaleronitrile, ammonium persulfate, potassium persulfate, sodium persulfate and sodium perphosphate.

The persulfates (peroxodisulfates), especially sodium persulfate, are most preferred.

The inverse dispersion can contain a mixture of the oxidizing component of redox initiator like t-butylhydroperoxide and potassium bromate and the preferred reducing component is sodium hydrogen sulfite.

In the performance of the emulsion polymerization, the initiator is used in a sufficient amount to initiate the polymerization reaction. The initiator is typically used in an amount of about 0.01 to 3% by weight, based on the total weight of the monomers used. The amount of initiator is preferably about 0.05 to 2% by weight and especially 0.1 to 1% by weight, based on the total weight of the monomers used.

The emulsion polymerization is effected typically at 0°C to 100°C. It can be performed either as a batch process or in the form of a feed process. In the feed method, at least a portion of the polymerization initiator and optionally a portion of the monomers are initially charged and heated to polymerization temperature, and then the rest of the polymerization mixture is supplied, typically over several separate feeds, one or more of which comprise the monomers in pure or emulsified form, continuously or stepwise while maintaining the polymerization. Preference is given to supplying the monomer in the form of a monomer emulsion. In parallel to the monomer supply, further polymerization initiator can be metered in.

In preferred embodiments, the entire amount of initiator is initially charged, i.e. there is no further metering of initiator parallel to the monomer feed.

In a preferred embodiment, the thermally activatable free-radical polymerization initiator is therefore initially charged completely and the monomer mixture, preferably in the form of a monomer emulsion, is fed in. Before the feeding of the monomer mixture is started, the initial charge is brought to the activation temperature of the thermally activatable free-radical polymerization initiator or a higher temperature. The activation temperature is considered to be the temperature at which at least half of the initiator has decomposed after one hour.

In another preferred preparation method, the cationic polymer is obtained by polymerization of a monomer mixture in the presence of a redox initiator system. A redox initiator system comprises at least one oxidizing agent component and at least one reducing agent component, in which case heavy metal ions are preferably additionally present as a catalyst in the reaction medium, for example salts of cerium, manganese or iron(II).

Suitable oxidizing agent components are, for example, sodium or potassium bromate, peroxides and/or hydroperoxides such as hydrogen peroxide, tert-butyl hydroperoxide, cumene hydroperoxide, pinane hydroperoxide, diisopropylphenyl hydroperoxide, dicyclohexyl percarbonate, dibenzoyl peroxide, dilauroyl peroxide and diacetyl peroxide. Hydrogen peroxide and tert-butyl hydroperoxide are preferred.

Suitable reducing agent components are alkali metal sulfites, alkali metal dithionites, alkali metal hyposulfites, sodium hydrogensulfite, Rongalit C (sodium formaldehydesulfoxylate), mono- and dihydroxyacetone, sugars (e.g. glucose or dextrose), ascorbic acid and salts thereof, acetone bisulfite adduct and/or an alkali metal salt of hydroxymethanesulfinic acid. Sodium hydrogensulfite or sodium metabisulfite is preferred.

Suitable reducing agent components or catalysts are also iron(II) salts, for example iron(II) sulfate, tin(II) salts, for example tin(II) chloride, titanium(III) salts such as titanium(III) sulfate.

The amounts of oxidizing agent used are 0.001 to 5.0% by weight, preferably from 0.005 to 1.0% by weight and more preferably from 0.01 to 0.5% by weight, based on the total weight of the monomers used. Reducing agents are used in amounts of 0.001 to 2.0% by weight, preferably of 0.005 to 1.0% by weight and more preferably of 0.01 to 0.5% by weight, based on the total weight of the monomers used.

A particularly preferred redox initiator system is the sodium peroxodisulfate/sodium hydrogensulfite system, for example 0.001 to 5.0% by weight of sodium peroxodisulfate and 0.001 to 2.0% by weight of sodium hydrogensulfite, especially 0.005 to 1.0% by weight of sodium peroxodisulfate and 0.005 to 1.0% by weight of sodium hydrogensulfite, more preferably 0.01 to 0.5% by weight of sodium peroxodisulfate and 0.01 to 0.5% by weight of sodium hydrogensulfite.

A further particularly preferred redox initiator system is the t-butyl hydroperoxide/hydrogen peroxide/ascorbic acid system, for example 0.001 to 5.0% by weight of t-butyl hydroperoxide, 0.001 to 5.0% by weight of hydrogen peroxide and 0.001 to 2.0% by weight of ascorbic acid, especially 0.005 to 1.0% by weight of t-butyl hydroperoxide, 0.005 to 1.0% by weight of hydrogen peroxide and 0.005 to 1.0% by weight of ascorbic acid, more preferably 0.01 to 0.5% by weight of t-butyl hydroperoxide, 0.01 to 0.5% by weight of hydrogen peroxide and 0.01 to 0.5% by weight of ascorbic acid.

In a preferred embodiment of this invention, both thermal initiators and redox initiators can be used together and one or more components of the used initiator compounds can be pre-fed partially or completely.

Emulsifiers, stabilizers, low-boiling oils and high-boiling oils as such are known to those skilled in the art. These compounds can be used individually or in the form of mixtures.

Typical emulsifiers in addition to the stabilizing agent are anionic emulsifiers, for example sodium laurylsulfate, sodium tridecyl ether sulfates, dioctylsulfosuccinate sodium salt and sodium salts of alkylaryl polyether sulfonates; and nonionic emulsifiers, for example alkylaryl polyether alcohols and ethylene oxide-propylene oxide copolymers. Sorbitan trioleate is likewise suitable as an emulsifier.

Preferred emulsifiers have the following general formula:

$R\text{-}O\text{-}(CH_2\text{-}CHR'\text{-}O)_n\text{-}X$

in which R is C_6-C_{30}-alkyl,
R′ is hydrogen or methyl,
X is hydrogen or SO_3M,
M is hydrogen or one alkali metal, and
n is an integer from 2 to 100.

Suitable stabilizers are described, for example, in EP-A 172 025 or EP-A 172 724. Preferred stabilizers are copolymers of stearyl methacrylate and methacrylic acid.

Suitable high-boiling oils are, for example, 2-ethylhexyl stearate and hydroheated heavy naphtha, and suitable low-boiling oils are, for example, dearomatized aliphatic hydrocarbons or mineral oils of low viscosity.

In a preferred embodiment of the present invention, compound A is completely or partially added to the oil phase in the inverse emulsion polymerization

In the inverse emulsion polymerization, the temperature can be kept constant or else it can rise. The rise in the temperature can be performed continuously or in stages. For example, the temperature can rise by 0.1 to 10°C per minute during the polymerization, preferably from 0.5 to 3°C per minute. The temperature rise is controlled by the rate of initiator addition. The starting temperature value may be 0 to 30°C, preferably 10 to 20°C.

In another embodiment of the present invention, the temperature in the inverse emulsion polymerization is kept constant (cold method); the temperature is 0 to 30°C, preferably 10 to 20°C. In a further embodiment of the present invention, the temperature is kept constant within a higher temperature range (hot method). The temperature in the polymerization is 40 to 150°C, preferably 70 to 120°C.

In a particularly preferred embodiment of the present invention, the temperature is kept constant during the inverse emulsion polymerization, the temperature being at least 40°C, preferably 50 to 90°C.

If, in the context of the present invention, the temperature is kept constant in a polymerization, especially in an inverse emulsion polymerization, this means that the temperature is kept at a constant value from the start of the polymerization. Variations of +/- 5°C, preferably +/- 2°C and especially +/- 1°C during the polymerization process are considered to be a constant temperature (based on the desired constant temperature value). The temperature is kept constant until the polymerization has ended, which is preferably the case after a conversion of more than 90% of the monomers used, more preferably more than 95% by weight and especially preferably at full conversion (100% by weight). The temperature can be kept constant by removing the heat of reaction which arises by cooling. The start of the polymerization is normally the addition of the polymerization initiator, preferably the addition of a redox initiator system. Normally, the system is first heated to the desired temperature and a constant temperature is awaited while stirring. Subsequently, the polymerization initiator is added, as a result of which the polymerization process commences. In one embodiment of the present invention, the temperature is kept constant at a value above the melting point of the associative monomer used.

In a preferred embodiment of the invention the polymerization starts at low temperatures and is increasing during the polymerization as described above until a special temperature is reached and then the polymerization temperature is kept constant by cooling.

The present invention preferably provides surfactant-containing alkaline formulations comprising at least one inventive thickener according to the above definitions. The pH of the formulation is 7 to 13.

The inventive inverse dispersion containing acidic or alkaline surfactant-containing aqueous formulations may comprise further ingredients known to those skilled in the art. Suitable ingredients comprise one or more substances from the group of the builders, bleaches, bleach activators, enzymes, electrolytes, non-aqueous solvents, pH modifiers, fragrances, perfume carriers, fluorescers, dyes, hydrotropes, foam inhibitors, silicone oils, antiredeposition agents, optical brighteners, graying inhibitors, antishrink agents, anticrease agents, dye transfer inhibitors, active antimicrobial ingredients, germicides, fungicides, antioxidants, corrosion inhibitors, antistats, ironing aids, hydrophobizing and impregnating agents, swelling and antislip agents, UV absorbers and fabric softening compounds.

In one embodiment of the present invention, the surfactant-containing formulations, comprise less than 1% by weight of inverse dispersion (based on the overall formulation), the cationic polymer of the inverse dispersion being obtained by inverse emulsion polymerization at increasing temperature. Preferably, the formulations comprise 0.01 to less than 1% by weight of thickener.

The present invention further provides for the use of an inventive surfactant-containing acidic formulation in hair cosmetics, in hair styling, as a shampoo, as a softener, as a conditioner, as a skin cream, as a shower gel, as a fabric softener for laundry, or as an acidic detergent, preferably for toilets or baths.

The present invention further provides for the use of a surfactant-containing alkaline formulation as a liquid washing composition or as a machine or manual dishwashing detergent.

The present invention further provides for the use of the inventive thickener as a viscosity modifier, for optimization of shear dilution, as a thickening agent, for stabilization of suspended constituents having a size in the range from nanometers to millimeters and/or in surfactant-containing acidic or alkaline formulations.

Fabric and/or Home Care Products

Fabric and Home Care Ingredients

Suitable Fabric Softening Actives

The fluid fabric enhancer compositions disclosed herein comprise a fabric softening active ("FSA"). Suitable fabric softening actives, include, but are not limited to, materials selected from the group consisting of quaternary ammonium compounds, amines, fatty esters, sucrose esters, silicones, dispersible polyolefins, clays, polysaccharides, fatty acids, softening oils, polymer latexes and mixtures thereof.

Non-limiting examples of water insoluble fabric care benefit agents include dispersible polyethylene and polymer latexes. These agents can be in the form of emulsions, latexes, dispersions, suspensions, and the like. In one aspect, they are in the form of an emulsion or a latex. Dispersible polyethylenes and polymer latexes can have a wide range of particle size diameters (χ_{50}) including but not limited to from about 1 nm to about 100 μm; alternatively from about 10 nm to about 10 μm. As such, the particle sizes of dispersible polyethylenes and polymer latexes are generally, but without limitation, smaller than silicones or other fatty oils.

Generally, any surfactant suitable for making polymer emulsions or emulsion polymerizations of polymer latexes can be used to make the water insoluble fabric care benefit agents of the present invention. Suitable surfactants consist of emulsifiers for polymer emulsions and latexes, dispersing agents for polymer dispersions and suspension agents for polymer suspensions. Suitable surfactants include anionic, cationic, and nonionic surfactants, or combinations thereof. In one aspect, such surfactants are nonionic and/or anionic surfactants. In one aspect, the ratio of surfactant to polymer in the water insoluble fabric care benefit agent is about 1:100 to about 1:2; alternatively from about 1:50 to about 1:5, respectively. Suitable water insoluble fabric care benefit agents include but are not limited to the examples described below.

Quats - Suitable quats include but are not limited to, materials selected from the group consisting of ester quats, amide quats, imidazoline quats, alkyl quats, amdioester quats and mixtures thereof. Suitable ester quats include but are not limited to, materials selected from the group consisting of monoester quats, diester quats, triester quats and mixtures thereof. In one aspect, a suitable ester quat is bis-(2-hydroxypropyl)-dimethylammonium methylsulfate fatty acid ester having a molar ratio of fatty acid moieties to amine moieties of from 1.85 to 1.99, an average chain length of the fatty acid moieties of from 16 to 18 carbon atoms and an iodine value of the fatty acid moieties, calculated for the free fatty acid, which has an Iodine Value of between 0-140, preferably 5-100, more preferably 10-80, even more preferably 15-70, even more preferably 18-55, most preferably 18-25. When a soft tallow quaternary ammonium compound softener is used, the most preferable range is 25-60. In one aspect, the cis-trans-ratio of double bonds of unsaturated fatty acid moieties of the bis-(2-hydroxypropyl)-dimethylammonium methylsulfate fatty acid ester is from 55:45 to 75:25, respectively. Suitable amide quats include but are not limited to, materials selected from the group consisting of monoamide quats, diamide quats and mixtures thereof. Suitable alkyl quats include but are not limited to, materials selected from the group consisting of mono alkyl quats, dialkyl quats quats, trialkyl quats, tetraalkyl quats and mixtures thereof.

Amines - Suitable amines include but are not limited to, materials selected from the group consisting of amidoesteramines, amidoamines, imidazoline amines, alkyl amines, amdioester amines and mixtures thereof. Suitable ester amines include but are not limited to, materials selected from the group consisting of monoester amines, diester amines, triester amines and mixtures thereof. Suitable amido quats include but are not limited to, materials selected from the group consisting of monoamido amines, diamido amines and mixtures thereof. Suitable alkyl amines include but are not limited to, materials selected from the group consisting of mono alkylamines, dialkyl amines quats, trialkyl amines, and mixtures thereof.

In one embodiment, the fabric softening active is a quaternary ammonium compound suitable for softening fabric in a rinse step. In one embodiment, the fabric softening active is formed from a reaction product of a fatty acid and an aminoalcohol obtaining mixtures of mono-, di-, and, in one embodiment, tri-ester compounds. In another embodiment, the fabric softening active comprises one or more softener quaternary ammonium compounds such, but not limited to, as a monoalkyquaternary ammonium compound, dialkylquaternary ammonium compound, a diamido quaternary compound, a diester quaternary ammonium compound, or a combination thereof.

In one aspect, the fabric softening active comprises a diester quaternary ammonium or protonated diester ammonium (hereinafter “DQA”) compound composition. In certain embodiments of the present invention, the DQA compound compositions also encompass diamido fabric softening actives s and fabric softening actives with mixed amido and ester linkages as well as the aforementioned diester linkages, all herein referred to as DQA.

In one aspect, said fabric softening active may comprise, as the principal active, compounds of the following formula:

$$\{R_{4-m} - N^{+} - [X - Y - R^{1}]_{m}\} X^{-} \qquad (1)$$

wherein each R comprises either hydrogen, a short chain C_1-C_6, in one aspect a C_1-C_3 alkyl or hydroxyalkyl group, for example methyl, ethyl, propyl, hydroxyethyl, and the like, poly(C_{2-3} alkoxy), polyethoxy, benzyl, or mixtures thereof; each X is independently $(CH_2)n$, CH_2-$CH(CH_3)$- or CH-(CH_3)-CH_2-; each Y may comprise -O-(O)C-, -C(O)-O-, -NR-C(O)-, or -C(O)-NR-; each m is 2 or 3; each n is from 1 to about 4, in one aspect 2; the sum of carbons in each R^1, plus one when Y is -O-(O)C- or -NR-C(O) -, may be C_{12}-C_{22}, or C_{14}-C_{20}, with each R^1 being a hydrocarbyl, or substituted hydrocarbyl group; and X^- may comprise any softener-compatible anion. In one aspect, the softener-compatible anion may comprise chloride, bromide, methylsulfate, ethylsulfate, sulfate, and nitrate. In another aspect, the softener-compatible anion may comprise chloride or methyl sulfate.

In another aspect, the fabric softening active may comprise the general 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:

$$[CH_3]_3 N^{(+)}[CH_2CH(CH_2O(O)CR^1)O(O)CR^1] C1^{(-)} \qquad (2)$$

wherein each R may comprise a methyl or ethyl group. In one aspect, each R^1 may comprise a C_{15} to C_{19} group. As used herein, when the diester is specified, it can include the monoester that is present.

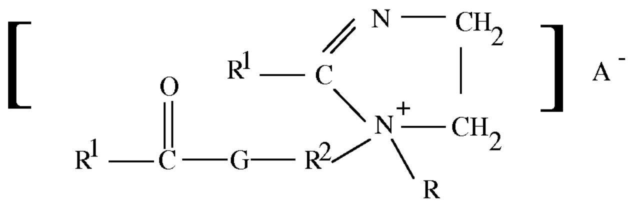
These types of agents and general methods of making them are disclosed in U.S.P.N. 4,137,180. An example of a suitable DEQA (2) is the "propyl" ester quaternary ammonium fabric softener active comprising the formula 1,2-di(acyloxy)-3-trimethylammoniopropane chloride.

A third type of useful fabric softening active has the formula:

$$[R_{4-m} - N^{+} - R^{1}_{m}] X^{-} \qquad (3)$$

wherein each R, R^1, m and X^- have the same meanings as before.

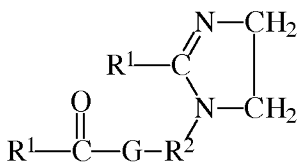
In a further aspect, the fabric softening active may comprise the formula:



(4)

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

In a yet further aspect, the fabric softening active may comprise the formula:



(5)

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

In a further aspect, the fabric softening active may comprise condensation reaction products of fatty acids with dialkylenetriamines in, e.g., a molecular ratio of about 2:1, said reaction products containing compounds of the formula:

$$R^1\text{—C(O)—NH—}R^2\text{—NH—}R^3\text{—NH—C(O)—}R^1 \qquad (6)$$

wherein R^1, R^2 are defined as above, and R^3 may comprise a C_{1-6} alkylene group, in one aspect, an ethylene group and wherein the reaction products may optionally be quaternized by the additional of an alkylating agent such as dimethyl sulfate. Such quaternized reaction products are described in additional detail in U.S.P.N. 5,296,622.

In a yet further aspect, the fabric softening active may comprise the formula:

$$[R^1\text{—C(O)—NR—}R^2\text{—N(R)}_2\text{—}R^3\text{—NR—C(O)—}R^1]^+ A^- \qquad (7)$$

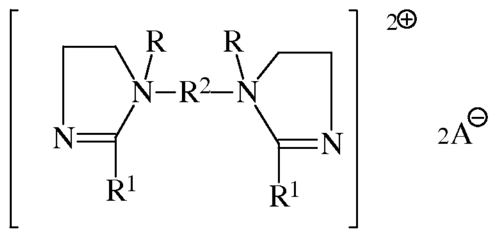
wherein R, R^1, R^2, R^3 and A^- are defined as above;

In a yet further aspect, the fabric softening active may comprise reaction products of fatty acid with hydroxyalkylalkylenediamines in a molecular ratio of about 2:1, said reaction products containing compounds of the formula:

$$R^1\text{-C(O)-NH-}R^2\text{-N(}R^3\text{OH)-C(O)-}R^1 \qquad (8)$$

wherein R^1, R^2 and R^3 are defined as above;

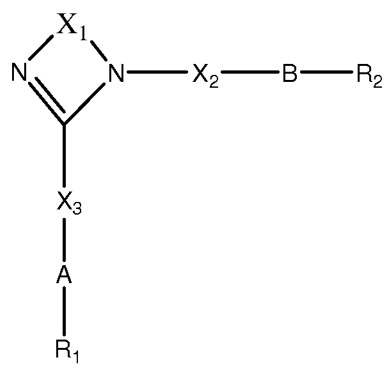
In a yet further aspect, the fabric softening active may comprise the formula:



(9)

wherein R, R^1, R^2, and A^- are defined as above.

In yet a further aspect, the fabric softening active may comprise the formula (10);



wherein;

X_1 is a $C_{2\text{-}3}$ alkyl group, in one aspect, an ethyl group;

X_2 and X_3 are independently $C_{1\text{-}6}$ linear or branched alkyl or alkenyl groups, in one aspect, methyl, ethyl or isopropyl groups;

R_1 and R_2 are independently $C_{8\text{-}22}$ linear or branched alkyl or alkenyl groups;

characterized in that;

A and B are independently selected from the group comprising -O-(C=O)-, -(C=O)-O-, or mixtures thereof, in one aspect, -0-(C=0)-

Non-limiting examples of fabric softening actives comprising formula (1) are N,N-bis(stearoyl-oxy-ethyl)-N,N-dimethyl ammonium chloride, N,N-bis(tallowoyl-oxy-ethyl)-N,N-dimethyl ammonium chloride, N,N-bis(stearoyl-oxy-ethyl)-N-(2 hydroxyethyl)-N-methyl ammonium methylsulfate.

Non-limiting examples of fabric softening actives comprising formula (2) is 1,2-di-(stearoyl-oxy)-3-trimethyl ammoniumpropane chloride.

Non-limiting examples of fabric softening actives comprising formula (3) include dialkylenedimethylammonium salts such as dicanoladimethylammonium chloride, di(hard)tallowdimethylammonium chloride, dicanoladimethylammonium methylsulfate, and mixtures thereof. An example of commercially available dialkylenedimethylammonium salts usable in the present invention is dioleyldimethylammonium chloride available from Witco Corporation under the trade name Adogen® 472 and dihardtallow dimethylammonium chloride available from Akzo Nobel Arquad 2HT75.

A non-limiting example of fabric softening actives comprising formula (4) is 1-methyl-1-stearoylamidoethyl-2-stearoylimidazolinium methylsulfate wherein R^1 is an acyclic aliphatic C_{15}-C_{17} hydrocarbon group, R^2 is an ethylene group, G is a NH group, R^5 is a methyl group and A^- is a methyl sulfate anion, available commercially from the Witco Corporation under the trade name Varisoft®.

A non-limiting example of fabric softening actives comprising formula (5) is 1-tallowylamidoethyl-2-tallowylimidazoline wherein R^1 is an acyclic aliphatic C_{15}-C_{17} hydrocarbon group, R^2 is an ethylene group, and G is a NH group.

A non-limiting example of a fabric softening active comprising formula (6) is the reaction products of fatty acids with diethylenetriamine in a molecular ratio of about 2:1, said reaction product mixture containing N,N"-dialkyldiethylenetriamine with the formula:

$$R^1\text{-C(O)-NH-CH}_2\text{CH}_2\text{-NH-CH}_2\text{CH}_2\text{-NH-C(O)-}R^1$$

wherein R^1 is an alkyl group of a commercially available fatty acid derived from a vegetable or animal source, such as Emersol® 223LL or Emersol® 7021, available from Henkel Corporation, and R^2 and R^3 are divalent ethylene groups.

A non-limiting example of Compound (7) is a di-fatty amidoamine based softener having the formula:

$$[R^1\text{-C(O)-NH-}CH_2CH_2\text{-N(}CH_3\text{)(}CH_2CH_2OH\text{)-}CH_2CH_2\text{-NH-C(O)-}R^1]^+ \; CH_3SO_4^-$$

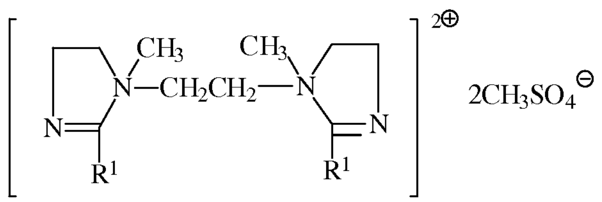
wherein R^1 is an alkyl group. An example of such compound is that commercially available from the Witco Corporation e.g. under the trade name Varisoft® 222LT.

An example of a fabric softening active comprising formula (8) is the reaction products of fatty acids with N-2-hydroxyethylethylenediamine in a molecular ratio of about 2:1, said reaction product mixture containing a compound of the formula:

$$R^1\text{-C(O)-NH-}CH_2CH_2\text{-N(}CH_2CH_2OH\text{)-C(O)-}R^1$$

wherein R^1-C(O) is an alkyl group of a commercially available fatty acid derived from a vegetable or animal source, such as Emersol® 223LL or Emersol® 7021, available from Henkel Corporation.

An example of a fabric softening active comprising formula (9) is the diquaternary compound having the formula:



wherein R^1 is derived from fatty acid. Such compound is available from Witco Company.

A non-limiting example of a fabric softening active comprising formula (10) is a dialkyl imidazoline diester compound, where the compound is the reaction product of N-(2-hydroxyethyl)-1,2-ethylenediamine or N-(2-hydroxyisopropyl)-1,2-ethylenediamine with glycolic acid, esterified with fatty acid, where the fatty acid is (hydrogenated) tallow fatty acid, palm fatty acid, hydrogenated palm fatty acid, oleic acid, rapeseed fatty acid, hydrogenated rapeseed fatty acid or a mixture of the above.

It will be understood that combinations of softener actives disclosed above are suitable for use in this invention.

Anion A

In the cationic nitrogenous salts herein, the anion A^-, which comprises any softener compatible anion, provides electrical neutrality. Most often, the anion used to provide electrical neutrality in these salts is from a strong acid, especially a halide, such as chloride, bromide, or iodide. However, other anions can be used, such as methylsulfate, ethylsulfate, acetate, formate, sulfate, carbonate, fatty acid anions and the like. In one aspect, the anion A may comprise chloride or methylsulfate. The anion, in some aspects, may carry a double charge. In this aspect, A^- represents half a group.

In one embodiment, the fabric softening agent comprises an fabric softening agent described in U.S. Pat. Pub. No. 2004/0204337 A1, published Oct. 14, 2004 to Corona et al., from paragraphs 30 – 79.

In another embodiment, the fabric softening agent is one described in U.S. Pat. Pub. No. 2004/0229769 A1, published Nov. 18, 2005, to Smith et al., on paragraphs 26 – 31; or U.S. Pat. No. 6,494,920, at column 1, line 51 *et seq.* detailing an "esterquat" or a quaternized fatty acid triethanolamine ester salt.

In one embodiment, the fabric softening agent is chosen from at least one of the following: ditallowoyloxyethyl dimethyl ammonium chloride, dihydrogenated-tallowoyloxyethyl dimethyl ammonium chloride, ditallow dimethyl ammonium chloride, dihydrogenatedtallow dimethyl ammonium chloride, ditallowoyloxyethyl methylhydroxyethylammonium methyl sulfate, dihydrogenated-tallowoyloxyethyl methyl hydroxyethylammonium chloride, or combinations thereof.

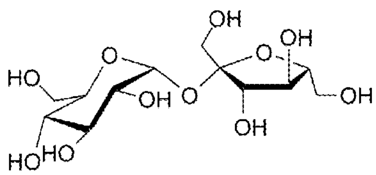
Polyssacharides

One aspect of the invention provides a fabric enhancer composition comprising a cationic starch as a fabric softening active. In one embodiment, the fabric care compositions of the present invention generally comprise cationic starch at a level of from about 0.1% to about 7%, alternatively from about 0.1% to about 5%, alternatively from about 0.3% to about 3%, and alternatively from about 0.5% to about 2.0%, by weight of the composition. Cationic starch as a fabric softening active is described in U.S. Pat. Pub. 2004/0204337 A1, published Oct. 14, 2004, to Corona et al., at paragraphs 16 – 32. Suitable cationic starches for use in the present compositions are commercially-available from Cerestar under the trade name C*BOND® and from National Starch and Chemical Company under the trade name CATO® 2A.

Sucrose esters

Nonionic fabric care benefit agents can comprise sucrose esters, and are typically derived from sucrose and fatty acids. Sucrose ester is composed of a sucrose moiety having one or more of its hydroxyl groups esterified.

Sucrose is a disaccharide having the following formula:



Alternatively, the sucrose molecule can be represented by the formula: $M(OH)_8$, wherein M is the disaccharide backbone and there are total of 8 hydroxyl groups in the molecule.

Thus, sucrose esters can be represented by the following formula:

$$M(OH)_{8-x}(OC(O)R^1)_x$$

wherein x is the number of hydroxyl groups that are esterified, whereas (8-x) is the hydroxyl groups that remain unchanged; x is an integer selected from 1 to 8, alternatively from 2 to 8, alternatively from 3 to 8, or from 4 to 8; and R^1 moieties are independently selected from C_1-C_{22} alkyl or C_1-C_{30} alkoxy, linear or branched, cyclic or acyclic, saturated or unsaturated, substituted or unsubstituted.

In one embodiment, the R^1 moieties comprise linear alkyl or alkoxy moieties having independently selected and varying chain length. For example, R^1 may comprise a mixture of linear alkyl or alkoxy moieties wherein greater than about 20% of the linear chains are C_{18}, alternatively greater than about 50% of the linear chains are C_{18}, alternatively greater than about 80% of the linear chains are C_{18}.

In another embodiment, the R^1 moieties comprise a mixture of saturate and unsaturated alkyl or alkoxy moieties; the degree of unsaturation can be measured by “Iodine Value” (hereinafter referred as “IV”, as measured by the standard AOCS method). The IV of the sucrose esters suitable for use herein ranges from about 1 to about 150, or from about 2 to about 100, or from about 5 to about 85. The R^1 moieties may be hydrogenated to reduce the degree of unsaturation. In the case where a higher IV is preferred, such as from about 40 to about 95, then oleic acid and fatty acids derived from soybean oil and canola oil are the starting materials.

In a further embodiment, the unsaturated R^1 moieties may comprise a mixture of “cis” and “trans” forms about the unsaturated sites. The “cis” / “trans” ratios may range from about 1:1 to about 50:1, or from about 2:1 to about 40:1, or from about 3:1 to about 30:1, or from about 4:1 to about 20:1.

Dispersible Polyolefins

Generally, all dispersible polyolefins that provide fabric care benefits can be used as water insoluble fabric care benefit agents in the present invention. The polyolefins can be in the format of waxes, emulsions, dispersions or suspensions. Non-limiting examples are discussed below.

In one embodiment, the polyolefin is chosen from a polyethylene, polypropylene, or a combination thereof. The polyolefin may be at least partially modified to contain various functional groups, such as carboxyl, alkylamide, sulfonic acid or amide groups. In another embodiment, the polyolefin is at least partially carboxyl modified or, in other words, oxidized.

For ease of formulation, the dispersible polyolefin may be introduced as a suspension or an emulsion of polyolefin dispersed by use of an emulsifying agent. The polyolefin suspension or emulsion may comprise from about 1% to about 60%, alternatively from about 10% to about 55%, alternatively from about 20% to about 50% by weight of polyolefin. The polyolefin may have a wax dropping point (see ASTM D3954- 94, volume 15.04 --- “Standard Test Method for Dropping Point of Waxes”) from about 20° to about 170°C, alternatively from about 50° to about 140°C. Suitable polyethylene waxes are available commercially from suppliers including but not limited to Honeywell (A-C polyethylene), Clariant (Velustrol® emulsion), and BASF (LUWAX®).

When an emulsion is employed with the dispersible polyolefin, the emulsifier may be any suitable emulsification agent. Non-limiting examples include an anionic, cationic, nonionic surfactant, or a combination thereof. However, almost any suitable surfactant or suspending agent may be employed as the emulsification agent. The dispersible polyolefin is dispersed by use of an emulsification agent in a ratio to polyolefin wax of about 1:100 to about 1:2, alternatively from about 1:50 to about 1:5, respectively.

Polymer Latexes

Polymer latex is made by an emulsion polymerization which includes one or more monomers, one or more emulsifiers, an initiator, and other components familiar to those of ordinary skill in the art. Generally, all polymer latexes that provide fabric care benefits can be used as water insoluble fabric care benefit agents of the present invention. Non-limiting examples of suitable polymer latexes include those disclosed in US 2004/0038851 A1; and US 2004/0065208 A1. Additional non-limiting examples include the monomers used in producing polymer latexes such as: (1) 100% or pure butylacrylate; (2) butylacrylate and butadiene mixtures with at least 20% (weight monomer ratio) of butylacrylate; (3) butylacrylate and less than 20% (weight monomer ratio) of other monomers excluding butadiene; (4) alkylacrylate with an alkyl carbon chain at or greater than C_6; (5) alkylacrylate with an alkyl carbon chain at or greater than C_6 and less than 50% (weight monomer ratio) of other monomers; (6) a third monomer (less than 20% weight monomer ratio) added into an aforementioned monomer systems; and (7) combinations thereof.

Polymer latexes that are suitable fabric care benefit agents in the present invention may include those having a glass transition temperature of from about –120°C to about 120°C, alternatively from about –80°C to about 60°C. Suitable emulsifiers include anionic, cationic, nonionic and amphoteric surfactants. Suitable initiators include initiators that are suitable for emulsion polymerization of polymer latexes. The particle size diameter (χ_{50}) of the polymer latexes can be from about 1 nm to about 10 µm, alternatively from about 10 nm to about 1 µm, or even from about 10 nm to about 20 nm.

Fatty Acid

One aspect of the invention provides a fabric softening composition comprising a fatty acid, such as a free fatty acid. The term “fatty acid” is used herein in the broadest sense to include unprotonated or protonated forms of a fatty acid; and includes fatty acid that is bound or unbound to another chemical moiety as well as the various combinations of these species of fatty acid. One skilled in the art will readily appreciate that the pH of an aqueous composition will dictate, in part, whether a fatty acid is protonated or unprotonated. In another embodiment, the fatty acid is in its unprotonated, or salt form, together with a counter ion, such as, but not limited to, calcium, magnesium, sodium, potassium and the like. The term “free fatty acid” means a fatty acid that is not bound (to another chemical moiety (covalently or otherwise) to another chemical moiety.

In one embodiment, the fatty acid may include those containing from about 12 to about 25, from about 13 to about 22, or even from about 16 to about 20, total carbon atoms, with the fatty moiety containing from about 10 to about 22, from about 12 to about 18, or even from about 14 (mid-cut) to about 18 carbon atoms.

The fatty acids of the present invention may be derived from (1) an animal fat, and/or a partially hydrogenated animal fat, such as beef tallow, lard, etc.; (2) a vegetable oil, and/or a partially hydrogenated vegetable oil such as canola oil, safflower oil, peanut oil, sunflower oil, sesame seed oil, rapeseed oil, cottonseed oil, corn oil, soybean oil, tall oil, rice bran oil, palm oil, palm kernel oil, coconut oil, other tropical palm oils, linseed oil, tung oil, etc.; (3) processed and/or bodied oils, such as linseed oil or tung oil via thermal, pressure, alkali-isomerization and catalytic treatments; (4) a mixture thereof, to yield saturated (e.g. stearic acid), unsaturated (e.g. oleic acid), polyunsaturated (linoleic acid), branched (e.g. isostearic acid) or cyclic (e.g. saturated or unsaturated α–disubstituted cyclopentyl or cyclohexyl derivatives of polyunsaturated acids) fatty acids. Non-limiting examples of fatty acids (FA) are listed in U.S. Pat. No. 5,759,990 at col 4, lines 45-66.

Mixtures of fatty acids from different fat sources can be used.

In one aspect, at least a majority of the fatty acid that is present in the fabric softening composition of the present invention is unsaturated, e.g., from about 40% to 100%, from about 55% to about 99%, or even from about 60% to about 98%, by weight of the total weight of the fatty acid present in the composition, although fully saturated and partially saturated fatty acids can be used. As such, the total level of polyunsaturated fatty acids (TPU) of the total fatty acid of the inventive composition may be from about 0% to about 75% by weight of the total weight of the fatty acid present in the composition.

The cis/trans ratio for the unsaturated fatty acids may be important, with the cis/trans ratio (of the C18:1 material) being from at least about 1:1, at least about 3:1, from about 4:1or even from about 9:1 or higher.

Branched fatty acids such as isostearic acid are also suitable since they may be more stable with respect to oxidation and the resulting degradation of color and odor quality.

The Iodine Value or "IV" measures the degree of unsaturation in the fatty acid. In one embodiment of the invention, the fatty acid has an IV from about 40 to about 140, from about 50 to about 120 or even from about 85 to about 105.

Another class of fatty ester fabric care actives is softening oils, which include but are not limited to, vegetable oils (such as soybean, sunflower, and canola), hydrocarbon based oils (natural and synthetic petroleum lubricants, in one aspect polyolefins, isoparaffins, and cyclic paraffins), triolein, fatty esters, fatty alcohols, fatty amines, fatty amides, and fatty ester amines. Oils can be combined with fatty acid softening agents, clays, and silicones.

Clays

In one embodiment of the invention, the fabric care composition may comprise a clay as a fabric care active. In one embodiment clay can be a softener or co-softeners with another softening active, for example, silicone. Suitable clays include those materials classified geologically smectites.

Silicone

In one embodiment, the fabric softening composition comprises a silicone. Suitable levels of silicone may comprise from about 0.1% to about 70%, alternatively from about 0.3% to about 40%, alternatively from about 0.5% to about 30%, alternatively from about 1% to about 20% by weight of the composition. Useful silicones can be any silicone comprising compound. In one embodiment, the silicone polymer is selected from the group consisting of cyclic silicones, polydimethylsiloxanes, aminosilicones, cationic silicones, silicone polyethers, silicone resins, silicone urethanes, and mixtures thereof. In one embodiment, the silicone is a polydialkylsilicone, alternatively a polydimethyl silicone (polydimethyl siloxane or "PDMS"), or a derivative thereof. In another embodiment, the silicone is chosen from an aminofunctional silicone, amino-polyether silicone, alkyloxylated silicone, cationic silicone, ethoxylated silicone, propoxylated silicone, ethoxylated/propoxylated silicone, quaternary silicone, or combinations thereof.

In another embodiment, the silicone may be chosen from a random or blocky organosilicone polymer having the following formula:

$$[R_1R_2R_3SiO_{1/2}]_{(j+2)}[(R_4Si(X\text{-}Z)O_{2/2}]_k[R_4R_4SiO_{2/2}]_m[R_4SiO_{3/2}]_j$$

wherein:

j is an integer from 0 to about 98; in one aspect j is an integer from 0 to about 48; in one aspect, j is 0;

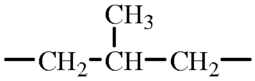
k is an integer from 0 to about 200, in one aspect k is an integer from 0 to about 50; when k = 0, at least one of R_1, R_2 or R_3 is –X—Z;

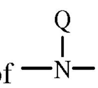
m is an integer from 4 to about 5,000; in one aspect m is an integer from about 10 to about 4,000; in another aspect m is an integer from about 50 to about 2,000;

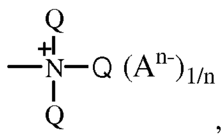
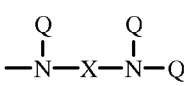
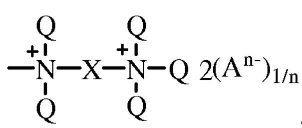
R_1, R_2 and R_3 are each independently selected from the group consisting of H, OH, C_1-C_{32} alkyl, C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl, C_6-C_{32} alkylaryl, C_6-C_{32} substituted alkylaryl, C_1-C_{32} alkoxy, C_1-C_{32} substituted alkoxy and X-Z;

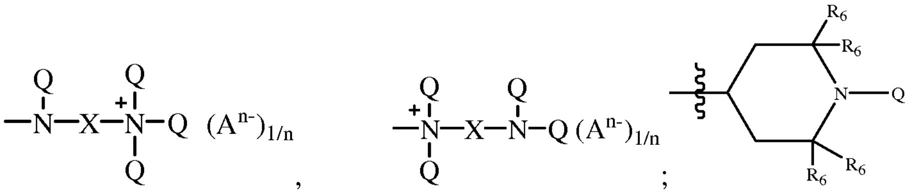
each R_4 is independently selected from the group consisting of H, OH, C_1-C_{32} alkyl, C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl, C_6-C_{32} alkylaryl, C_6-C_{32} substituted alkylaryl, C_1-C_{32} alkoxy and C_1-C_{32} substituted alkoxy;

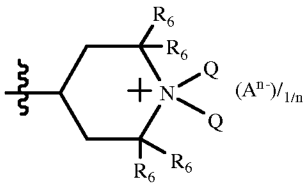
each X in said alkyl siloxane polymer comprises a substituted or unsubsitituted divalent alkylene radical comprising 2-12 carbon atoms, in one aspect each divalent alkylene radical is independently selected from the group consisting of $-(CH_2)_s-$ wherein s is an integer from about 2 to about 8, from about 2 to about 4; in one aspect, each X in said alkyl siloxane polymer comprises a substituted divalent alkylene radical selected from the group consisting of: $–CH_2–CH(OH)-CH_2–$; $–CH_2–CH_2-CH(OH)–$; and

;

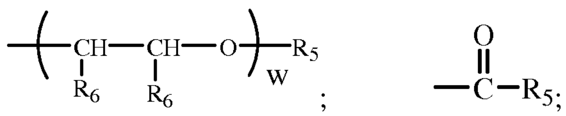
each Z is selected independently from the group consisting of ,

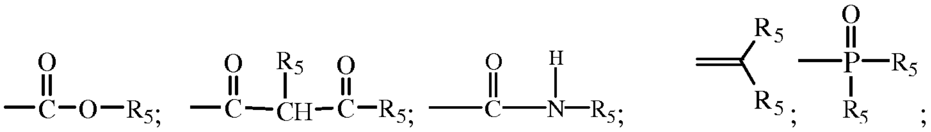
, , ,

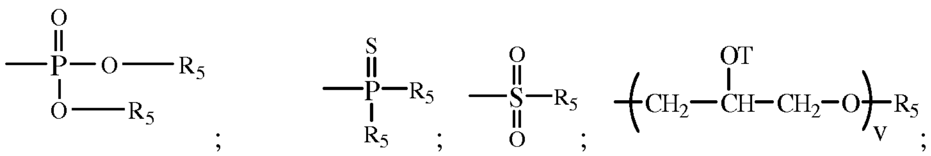


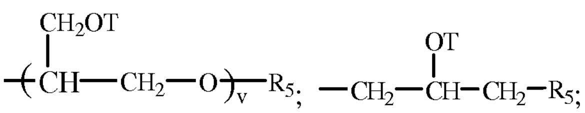
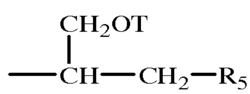


and with the proviso that when Z is a quat, Q cannot be an amide, imine, or urea moiety and if Q is an amide, imine, or urea moiety, then any additional Q bonded to the same nitrogen as said amide, imine, or urea moiety must be H or a C_1-C_6 alkyl, in one aspect, said additional Q is H; for Z A^{n-} is a suitable charge balancing anion. In one aspect A^{n-} is selected from the group consisting of Cl^-, Br^-,I^-, methylsulfate, toluene sulfonate, carboxylate and phosphate; and at least one Q in said organosilicone is independently selected from

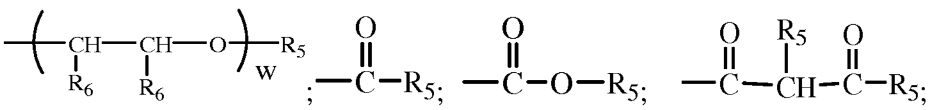
$–CH_2–CH(OH)-CH_2-R_5$; 

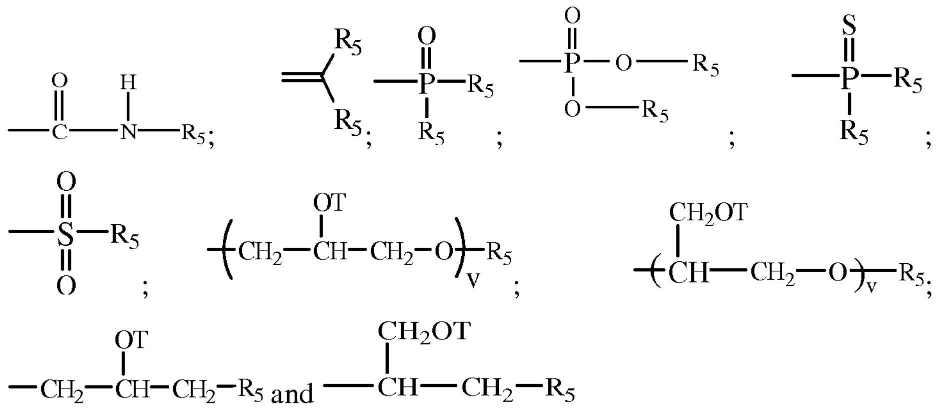




 and 

each additional Q in said organosilicone is independently selected from the group comprising of H, C_1-C_{32} alkyl, C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl, C_6-C_{32} alkylaryl, C_6-C_{32} substituted alkylaryl, $–CH_2–CH(OH)-CH_2-R_5$;





wherein each R_5 is independently selected from the group consisting of H, C_1-C_{32} alkyl, C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl, C_6-C_{32} alkylaryl, C_6-C_{32} substituted alkylaryl, –(CHR_6-CHR_6-O-$)_w$-L and a siloxyl residue;

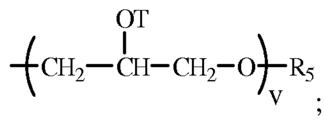
each R_6 is independently selected from H, C_1-C_{18} alkyl

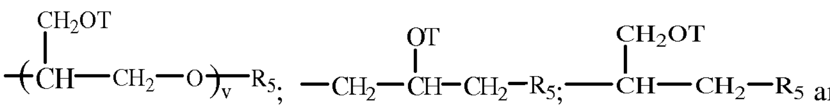
each L is independently selected from –C(O)-R_7 or

R_7;

w is an integer from 0 to about 500, in one aspect w is an integer from about 1 to about 200; in one aspect w is an integer from about 1 to about 50;

each R_7 is selected independently from the group consisting of H; C_1-C_{32} alkyl; C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl, C_6-C_{32} alkylaryl; C_6-C_{32} substituted alkylaryl and a siloxyl residue;

each T is independently selected from H, and 

 and

wherein each v in said organosilicone is an integer from 1 to about 10, in one aspect, v is an integer from 1 to about 5 and the sum of all v indices in each Q in the said organosilicone is an integer from 1 to about 30 or from 1 to about 20 or even from 1 to about 10.

In another embodiment, the silicone may be chosen from a random or blocky organosilicone polymer having the following formula:

$$[R_1R_2R_3SiO_{1/2}]_{(j+2)}[(R_4Si(X\text{-}Z)O_{2/2}]_k[R_4R_4SiO_{2/2}]_m[R_4SiO_{3/2}]_j$$

wherein

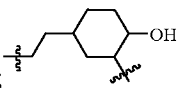
j is an integer from 0 to about 98; in one aspect j is an integer from 0 to about 48; in one aspect, j is 0;

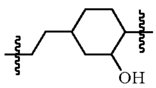
k is an integer from 0 to about 200; when k = 0, at least one of R_1, R_2 or R_3= -X-Z, in one aspect, k is an integer from 0 to about 50

m is an integer from 4 to about 5,000; in one aspect m is an integer from about 10 to about 4,000; in another aspect m is an integer from about 50 to about 2,000;

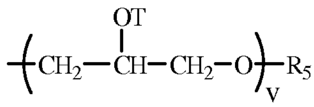
R_1, R_2 and R_3 are each independently selected from the group consisting of H, OH, C_1-C_{32} alkyl, C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl, C_6-C_{32} alkylaryl, C_6-C_{32} substituted alkylaryl, C_1-C_{32} alkoxy, C_1-C_{32} substituted alkoxy and X-Z;

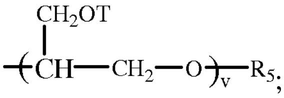
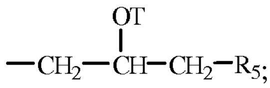
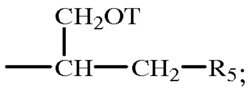
each R_4 is independently selected from the group consisting of H, OH, C_1-C_{32} alkyl, C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl, C_6-C_{32} alkylaryl, C_6-C_{32} substituted alkylaryl, C_1-C_{32} alkoxy and C_1-C_{32} substituted alkoxy;

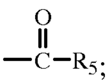
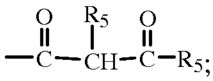
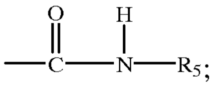
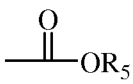
each X comprises of a substituted or unsubstituted divalent alkylene radical comprising 2-12 carbon atoms; in one aspect each X is independently selected from the group consisting of $-(CH_2)_s$-O-; $-CH_2-CH(OH)-CH_2-O-$; $-CH_2-CH(CH_3)-CH_2-O-$; 

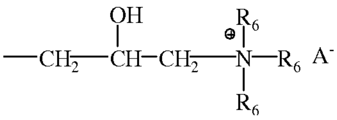
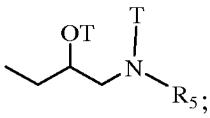
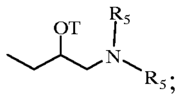
and 

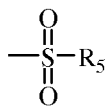
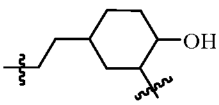
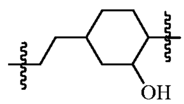
wherein each s independently is an integer from about 2 to about 8, in one aspect s is an integer from about 2 to about 4;

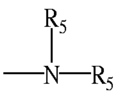
At least one Z in the said organosiloxane is selected from the group consisting of R_5;  ;

    ;

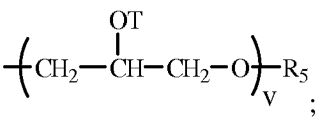
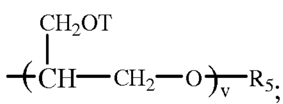
 ;  

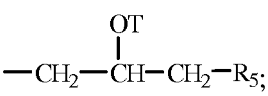
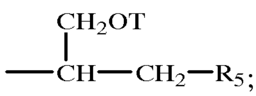
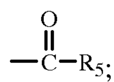
$—C(R_5)_2O—R_5$; $—C(R_5)_2S—R_5$ and  provided that when X is  or  then Z = $-OR_5$ or

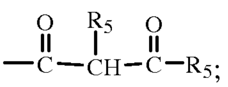


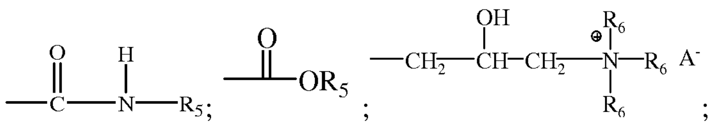
wherein A^- is a suitable charge balancing anion. In one aspect A^- is selected from the group consisting of Cl^-, Br^-,

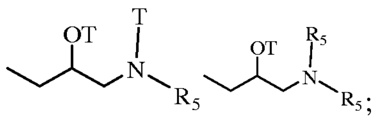
I^-, methylsulfate, toluene sulfonate, carboxylate and phosphate and

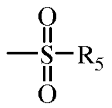
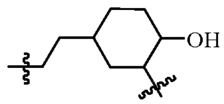
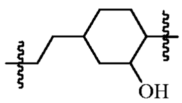
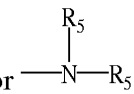
each additional Z in said organosilicone is independently selected from the group comprising of H, C_1-C_{32} alkyl, C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl, C_6-C_{32} alkylaryl, C_6-C_{32} substituted alkylaryl, R_5,  ; 

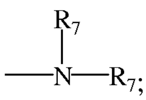
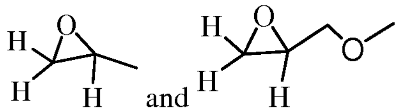




 $—C(R_5)_2O—R_5$;$—C(R_5)_2S—R_5$

and  provided that when X is  or  then Z = $-OR_5$ or 

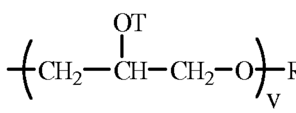
each R_5 is independently selected from the group consisting of H; C_1-C_{32} alkyl; C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl or C_6-C_{32} alkylaryl, or C_6-C_{32} substituted alkylaryl,

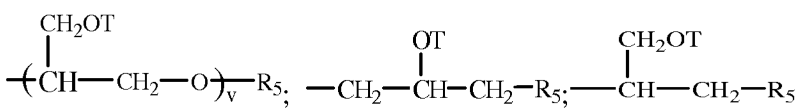
$–(CHR_6$-CHR_6-O-$)_w$-CHR_6-CHR_6-L and siloxyl residue wherein each L is independently selected from -O–C(O)-R_7 or –O-R_7;  

w is an integer from 0 to about 500, in one aspect w is an integer from 0 to about 200, one aspect w is an integer from 0 to about 50;

each R_6 is independently selected from H or C_1-C_{18} alkyl;

each R_7 is independently selected from the group consisting of H; C_1-C_{32} alkyl; C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl, C_6-C_{32} alkylaryl, and C_6-C_{32} substituted aryl, and a siloxyl residue;

each T is independently selected from H;  ;



wherein each v in said organosilicone is an integer from 1 to about 10, in one aspect, v is an integer from 1 to about 5 and the sum of all v indices in each Z in the said organosilicone is an integer from 1 to about 30 or from 1 to about 20 or even from 1 to about 10.

In one embodiment, the silicone is one comprising a relatively high molecular weight. A suitable way to describe the molecular weight of a silicone includes describing its viscosity. A high molecular weight silicone is one having a viscosity of from about 10 cSt to about 3,000,000 cSt, or from about100 cSt to about 1,000,000 cSt, or from about 1,000 cSt to about 600,000 cSt, or even from about 6,000 cSt to about 300,000 cSt.

In one embodiment, the silicone comprises a blocky cationic organopolysiloxane having the formula:

$$M_wD_xT_yQ_z$$

wherein:

$M = [SiR_1R_2R_3O_{1/2}]$, $[SiR_1R_2G_1O_{1/2}]$, $[SiR_1G_1G_2O_{1/2}]$, $[SiG_1G_2G_3O_{1/2}]$, or combinations thereof;

$D = [SiR_1R_2O_{2/2}]$, $[SiR_1G_1O_{2/2}]$, $[SiG_1G_2O_{2/2}]$ or combinations thereof;

$T = [SiR_1O_{3/2}]$, $[SiG_1O_{3/2}]$ or combinations thereof;

$Q = [SiO_{4/2}]$;

w = is an integer from 1 to (2+y+2z);

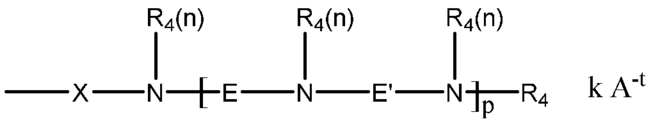
x = is an integer from 5 to 15,000;

y = is an integer from 0 to 98;

z = is an integer from 0 to 98;

R_1, R_2 and R_3 are each independently selected from the group consisting of H, OH, C_1-C_{32} alkyl, C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl, C_6-C_{32} alkylaryl, C_6-C_{32} substituted alkylaryl, C_1-C_{32} alkoxy, C_1-C_{32} substituted alkoxy, C_1-C_{32} alkylamino, and C_1-C_{32} substituted alkylamino;

at least one of M, D, or T incorporates at least one moiety G_1, G_2 or G_3; and G_1, G_2, and G_3 are each independently selected from the formula:



wherein:

X comprises a divalent radical selected from the group consisting of C_1-C_{32} alkylene, C_1-C_{32} substituted alkylene, C_5-C_{32} or C_6-C_{32} arylene, C_5-C_{32} or C_6-C_{32} substituted arylene, C_6-C_{32} arylalkylene, C_6-C_{32} substituted arylalkylene, C_1-C_{32} alkoxy, C_1-C_{32} substituted alkoxy, C_1-C_{32} alkyleneamino, C_1-C_{32} substituted alkyleneamino, ring-opened epoxide, and ring-opened glycidyl, with the proviso that if X does not comprise a repeating alkylene oxide moiety then X can further comprise a heteroatom selected from the group consisting of P, N and O;

each R_4 comprises identical or different monovalent radicals selected from the group consisting of H, C_1-C_{32} alkyl, C_1-C_{32} substituted alkyl, C_5-C_{32} or C_6-C_{32} aryl, C_5-C_{32} or C_6-C_{32} substituted aryl, C_6-C_{32} alkylaryl, and C_6-C_{32} substituted alkylaryl;

E comprises a divalent radical selected from the group consisting of C_1-C_{32} alkylene, C_1-C_{32} substituted alkylene, C_5-C_{32} or C_6-C_{32} arylene, C_5-C_{32} or C_6-C_{32} substituted arylene, C_6-C_{32} arylalkylene, C_6-C_{32} substituted arylalkylene, C_1-C_{32} alkoxy, C_1-C_{32} substituted alkoxy, C_1-C_{32} alkyleneamino, C_1-C_{32} substituted alkyleneamino, ring-opened epoxide and ring-opened glycidyl, with the proviso that if E does not comprise a repeating alkylene oxide moiety then E can further comprise a heteroatom selected from the group consisting of P, N, and O;

E' comprises a divalent radical selected from the group consisting of C_1-C_{32} alkylene, C_1-C_{32} substituted alkylene, C_5-C_{32} or C_6-C_{32} arylene, C_5-C_{32} or C_6-C_{32} substituted arylene, C_6-C_{32} arylalkylene, C_6-C_{32} substituted arylalkylene, C_1-C_{32} alkoxy, C_1-C_{32} substituted alkoxy, C_1-C_{32} alkyleneamino, C_1-C_{32} substituted alkyleneamino, ring-opened epoxide and ring-opened glycidyl, with the proviso that if E' does not comprise a repeating alkylene oxide moiety then E' can further comprise a heteroatom selected from the group consisting of P, N, and O;

p is an integer independently selected from 1 to 50;
n is an integer independently selected from 1 or 2;

when at least one of G_1, G_2, or G_3 is positively charged, A^{-t} is a suitable charge balancing anion or anions such that the total charge, k, of the charge-balancing anion or anions is equal to and opposite from the net charge on the moiety G_1, G_2 or G_3; wherein t is an integer independently selected from 1, 2, or 3; and $k \leq (p*2/t) + 1$; such that the total number of cationic charges balances the

total number of anionic charges in the organopolysiloxane molecule;
and wherein at least one E does not comprise an ethylene moiety.

Process of Making Polymers

Polymers useful in the present invention can be made by one skilled in the art. Examples of processes for making polymers include, but are not limited, solution polymerization, emulsion polymerization, inverse emulsion polymerization, inverse dispersion polymerization, and liquid dispersion polymer technology. In one aspect, a method of making a polymer having a chain transfer agent (CTA) value in a range greater than 1000 ppm by weight of the polymer is disclosed. Another aspect of the invention is directed to providing a polymer having a cross linker greater than 5 ppm, alternatively greater than 45 ppm, by weight of the polymer. Without wishing to be bound by theory, it is believed that a polymer comprising a high level of CTA and/or high level of cross linker can surprisingly provide a fabric care composition having surprisingly superior softener active and/or perfume deposition.

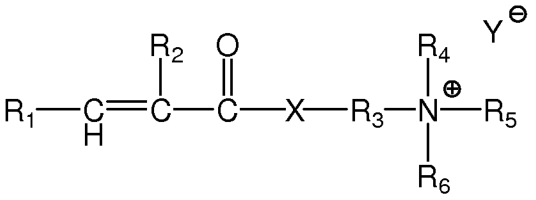
In one aspect of making a polymer, the CTA is present in a range greater than about 100 ppm based on the weight of the polymer. In one aspect, the CTA is from about 100 ppm to about 10,000 ppm, alternatively from about 500 ppm to about 4,000 ppm, alternatively from about 1,000 ppm to about 3,500 ppm, alternatively from about 1,500 ppm to about 3,000 ppm, alternatively from about 1,500 ppm to about 2,500 ppm, alternatively combinations thereof based on the weight of the polymer. In yet another aspect, the CTA is greater than about 1,000 based on the weight of the polymer. It is also suitable to use mixtures of chain transfer agents.

In one aspect of the invention, the polymer comprises 5-95% by weight (wt-%) of at least one cationic monomer and 5-95 wt-% of at least one non-ionic monomer. The weight percentages relate to the total weight of the copolymer.

In yet still another aspect of the invention, the polymer comprises 50-70 wt-%, or 55 - 65wt-%, of at least one cationic monomer and 30 – 50 wt-%, or 35-45 wt-%, of at least one non-ionic monomer. The weight percentages relate to the total weight of the copolymer.

Cationic Monomers for Polymers

Suitable cationic monomers include dialkyl ammonium halides or compounds according to formula (I):



(I)

wherein:

R_1 is chosen hydrogen, or $C_1 - C_4$ alkyl, in one aspect, R_1 is hydrogen or methyl;

R_2 is chosen from hydrogen or methyl, in one aspect, R_1 is hydrogen

R_3 is chosen $C_1 - C_4$ alkylene, in one aspect, R_3 is ethylene;

R_4, R_5, and R_6 are each independently chosen from hydrogen, $C_1 - C_4$ alkyl alcohol, $C_1 - C_4$ alkoxy alcohol, or $C_1 - C_4$ alkyl, in one aspect, R_4, R_5, and R_6 are methyl;

X is chosen from -O-, or -NH-, in one aspect, X is -O-; and

Y is chosen from Cl, Br, I, hydrogensulfate or methylsulfate, in one aspect, Y is Cl.

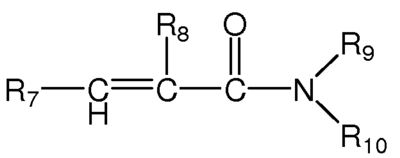
The alkyl groups may be linear or branched. The alkyl groups are methyl, ethyl, propyl, butyl, and isopropyl.

In one aspect, the cationic monomer of formula (I) is dimethyl aminoethyl acrylate methyl chloride. In another aspect, the cationic monomer of formula (I) is dimethyl aminoethyl methacrylate methyl chloride.

In another aspect, the cationic monomer is dialkyldimethyl ammonium chloride.

Non-ionic Monomers for Polymers

Suitable non-ionic monomers include compounds of formula (II) wherein



(II)

wherein:

R_7 is chosen from hydrogen or $C_1 - C_4$ alkyl; in one aspect R_7 is hydrogen;

R_8 is chosen from hydrogen or methyl; in one aspect, R_8 is hydrogen; and

R_9 and R_{10} are each independently chosen from hydrogen or $C_1 - C_4$ alkyl; in one aspect, R_9 and R_{10} are each independently chosen from hydrogen or methyl.

In one aspect, the non-ionic monomer is acrylamide.

In another aspect, the non-ionic monomer is hydroxyethyl acrylate.

<u>Anionic Monomers for Polymers</u>

Suitable anionic monomers include acrylic acid, methacrylic acid, maleic acid, vinyl sulfonic acid, styrene sulfonic acid, acrylamidopropylmethane sulfonic acid (AMPS) and their salts.

<u>Cross-linking Agent for Polymers</u>

The cross-linking agent contains at least two ethylenically unsaturated moieties. In one aspect, the cross-linking agent contains at least three or more ethylenically unsaturated moieties; in one aspect, the cross-linking agent contains at least four or more ethylenically unsaturated moieties.

Suitable cross-linking agents include divinyl benzene, tetraallylammonium chloride; allyl acrylates; allyl acrylates and methacrylates, diacrylates and dimethacrylates of glycols and polyglycols, allyl methacrylates; and tri- and tetramethacrylates of polyglycols; or polyol polyallyl ethers such as polyallyl sucrose or pentaerythritol triallyl ether, butadiene, 1,7-octadiene, allyl-acrylamides and allyl-methacrylamides, bisacrylamidoacetic acid, N,N′-methylene-bisacrylamide and polyol polyallylethers, such as polyallylsaccharose and pentaerythrol triallylether, ditrimethylolpropane tetraacrylate, pentaerythrityl tetraacrylate, pentaerythrityl tetramethacrylate, pentaerythrityl triacrylate, pentaerythrityl triacrylate ethoxylate, Triethanolamine trimethacrylate, 1,1,1-trimethylolpropane triacrylate, 1,1,1-trimethylolpropane triacrylate, ethoxylated, trimethylolpropane tris(polyethylene glycol ether) triacrylate, 1,1,1-trimethylolpropane trimethacrylate, tris-(2-hydroxyethyl)-1,3,5-triazine-2,4,6-trione triacrylate, tris-(2-hydroxyethyl)-1,3,5-triazine-2,4,6-trione trimethacrylate, dipentaerythrityl pentaacrylate, 3-(3-{[dimethyl-(vinyl)-silyl]-oxy}-1,1,5,5-tetramethyl-1,5-divinyl-3-trisiloxanyl)-propyl methacrylate, dipentaerythritol hexaacrylate, 1-(2-propenyloxy)-2,2-bis[(2-propenyloxy)-methyl]-

butane, trimethacrylic acid-1,3,5-triazin-2,4,6-triyltri-2,1-ethandiyl ester, glycerine triacrylate propoxylate, 1,3,5-triacryloylhexahydro-1,3,5-triazine, 1,3-dimethyl-1,1,3,3-tetravinyldisiloxane, pentaerythrityl tetravinyl ether, 1,3-dimethyl-1,1,3,3-tetravinyldisiloxane, (Ethoxy)-trivinylsilane, (Methyl)-trivinylsilane, 1,1,3,5,5-pentamethyl-1,3,5-trivinyltrisiloxane, 1,3,5-trimethyl-1,3,5-trivinylcyclotrisilazane, 2,4,6-trimethyl-2,4,6-trivinylcyclotrisiloxane, 1,3,5-trimethyl-1,3,5-trivinyltrisilazane, tris-(2-butanone oxime)-vinylsilane, 1,2,4-trivinylcyclohexane, trivinylphosphine, trivinylsilane, methyltriallylsilane, pentaerythrityl triallyl ether, phenyltriallylsilane, triallylamine, triallyl citrate, triallyl phosphate, triallylphosphine, triallyl phosphite, triallylsilane, 1,3,5-triallyl-1,3,5-triazine-2,4,6(1H,3H,5H)-trione, trimellitic acid triallyl ester, trimethallyl isocyanurate, 2,4,6-tris-(allyloxy)-1,3,5-triazine, 1,2-bis-(diallylamino)-ethane, pentaerythrityl tetratallate, 1,3,5,7-tetravinyl-1,3,5,7-tetramethylcyclotetrasiloxane, 1,3,5,7-tetravinyl-1,3,5,7-tetramethylcyclotetrasiloxane, tris-[(2-acryloyloxy)-ethyl]-phosphate, vinylboronic anhydride pyridine, 2,4,6-trivinylcyclotriboroxanepyridine, tetraallylsilane, tetraallyloxysilane, 1,3,5,7-tetramethyl-1,3,5,7-tetravinylcyclotetrasilazane. Preferred cross-linking agents are alkyltrimethylammonium chloride, pentaerythrityl triacrylate, pentaerythrityl tetraacrylate, tetrallylammonium chloride, 1,1,1-trimethylolpropane tri(meth)acrylate, or a mixture thereof. These preferred compounds can also be ethoxylated and mixtures thereof. In one aspect, the cross-linking agents are chosen from tetraallyl ammonium chloride, allyl-acrylamides and allyl-methacrylamides, bisacrylamidoacetic acid, and N,N′-methylene-bisacrylamide, and mixtures thereof. In one aspect, the cross-linking agent is tetraallyl ammonium chloride. In another aspect, the cross-linking agent is a mixture of pentaerythrityl triacrylate and pentaerythrityl tetraacrylate.

For Polymer 1, the crosslinker(s) is (are) included in the range of from about 45 ppm to about 5,000 ppm, alternatively from about 50 ppm to about 500 ppm; alternatively from about 100 ppm to about 400 ppm, alternatively from about 500 ppm to about 4,500 ppm, alternatively from about 550 ppm to about 4,000 ppm based on the weight of the polymer.

For Polymer 2, the crosslinker(s) is (are) included in the range from 0 ppm to about 40 ppm, alternatively from about 0 ppm to about 20 ppm; alternatively from about 0 ppm to about 10 ppm based on the weight of the polymer.

Chain Transfer Agent (CTA) for Polymers

The chain transfer agent includes mercaptans, malic acid, lactic acid, formic acid, isopropanol and hypophosphites, and mixtures thereof. In one aspect, the CTA is formic acid.

The CTA is present in a range greater than about 100 ppm based on the weight of the polymer. In one aspect, the CTA is present from about 100 ppm to about 10,000 ppm, alternatively from about 500 ppm to about 4,000 ppm, alternatively from about 1,000 ppm to about 3,500 ppm, alternatively from about 1,500 ppm to about 3,000 ppm, alternatively from about 1,500 ppm to about 2,500 ppm, alternatively combinations thereof based on the weight of the polymer. In yet another aspect, the CTA level is greater than about 1,000 based on the weight of the polymer. It is also suitable to use mixtures of chain transfer agents.

Molecular Weight Range for Polymers

In one aspect, the polymer comprises a Number Average Molecular Weight (Mn) from about 10,000 Daltons to about 20,000,000 Daltons, alternatively from about 1,500,000 Daltons to about 2,500,000 Daltons.

In another aspect, the polymer comprises a Weight Average Molecular Weight (Mw) from about 4,000,000 Daltons to about 11,000,000 Daltons, alternatively from about 4,000,000 Daltons to about 6,000,00 Daltons.

One example of the present invention is the inverse emulsion polymerization of acrylamide and methyl chloride quaternized dimethylaminoethylammonium acrylate (DMA3) in the presence of a cross-linker and chain transfer agent to produce a polymer mixture wherein the micro-gel colloidal glass has a particle content as measured by ultracentrifugation of 69%. The remaining polymer portion of the composition is a mixture of linear and/or slightly branched polymers.

Stabilizing agents for polymer synthesis and examples

Stabilizing agent A (nonionic block copolymer): Polyglyceryl-dipolyhydroxystearate with CAS-No. 144470-58-6.

Stabilizing agent B is a nonionic ABA-block copolymer with molecular weight of about 5000g/mol, and a hydrophobic lipophilic balance value (HLB) of 5 to 6, wherein the A block is based on polyhydroxystearic acid and the B block on polyalkylene oxide.

Stabilizing agent C (nonionic block copolymer): PEG-30 Dipolyhydroxystearate, with CAS-Nr. 70142-34-6

Stabilizing agent D (nonionic block copolymer): Alcyd Polyethylenglycol Poly-isobutene stabilizing surfactant with HLB 5-7

Adjunct Materials

While not essential for the purposes of the present invention, the non-limiting list of adjuncts illustrated hereinafter are suitable for use in the instant compositions and may be desirably incorporated in certain aspects of the invention, for example to assist or enhance cleaning performance, for treatment of the substrate to be cleaned, or to modify the aesthetics of the composition as is the case with perfumes, colorants, dyes or the like. The precise nature of these additional components, and levels of incorporation thereof, will depend on the physical form of the composition and the nature of the fabric treatment operation for which it is to be used. Suitable adjunct materials include, but are not limited to, surfactants, builders, chelating agents, dye transfer inhibiting agents, dispersants, enzymes, and enzyme stabilizers, catalytic materials, bleach activators, hydrogen peroxide, sources of hydrogen peroxide, preformed peracids, polymeric dispersing agents, clay soil removal/anti-redeposition agents, brighteners, suds suppressors, dyes, hueing dyes, perfumes, perfume delivery systems, structure elasticizing agents, carriers, structurants, hydrotropes, processing aids, solvents and/or pigments.

As stated, the adjunct ingredients are not essential to Applicants' compositions. Thus, certain aspects of Applicants' compositions do not contain one or more of the following adjuncts materials: surfactants, builders, chelating agents, dye transfer inhibiting agents, dispersants, enzymes, and enzyme stabilizers, catalytic materials, bleach activators, hydrogen peroxide, sources of hydrogen peroxide, preformed peracids, polymeric dispersing agents, clay soil removal/anti-redeposition agents, brighteners, suds suppressors, dyes, hueing dyes, perfumes, perfume delivery systems structure elasticizing agents, carriers, hydrotropes, processing aids, solvents and/or pigments. However, when one or more adjuncts are present, such one or more adjuncts may be present as detailed below.

Hueing Dye - The liquid laundry detergent composition may comprise a hueing dye. The hueing dyes employed in the present laundry care compositions may comprise polymeric or non-polymeric dyes, organic or inorganic pigments, or mixtures thereof. Preferably the hueing dye comprises a polymeric dye, comprising a chromophore constituent and a polymeric constituent. The chromophore constituent is characterized in that it absorbs light in the wavelength range of blue, red, violet, purple, or combinations thereof upon exposure to light. In one aspect, the chromophore constituent exhibits an absorbance spectrum maximum from about 520 nanometers to about 640 nanometers in water and/or methanol, and in another aspect, from about 560 nanometers to about 610 nanometers in water and/or methanol.

Although any suitable chromophore may be used, the dye chromophore is preferably selected from benzodifuranes, methine, triphenylmethanes, napthalimides, pyrazole, napthoquinone, anthraquinone, azo, oxazine, azine, xanthene, triphenodioxazine and phthalocyanine dye chromophores. Mono and di-azo dye chromophores are may be preferred.

The hueing dye may comprise a dye polymer comprising a chromophore covalently bound to one or more of at least three consecutive repeat units. It should be understood that the repeat units themselves do not need to comprise a chromophore. The dye polymer may comprise at least 5, or at least 10, or even at least 20 consecutive repeat units.

The repeat unit can be derived from an organic ester such as phenyl dicarboxylate in combination with an oxyalkyleneoxy and a polyoxyalkyleneoxy. Repeat units can be derived from alkenes, epoxides, aziridine, carbohydrate including the units that comprise modified celluloses such as hydroxyalkylcellulose; hydroxypropyl cellulose; hydroxypropyl methylcellulose; hydroxybutyl cellulose; and, hydroxybutyl methylcellulose or mixtures thereof. The repeat units may be derived from alkenes, or epoxides or mixtures thereof. The repeat units may be C_2-C_4 alkyleneoxy groups, sometimes called alkoxy groups, preferably derived from C_2-C_4 alkylene oxide. The repeat units may be C_2-C_4 alkoxy groups, preferably ethoxy groups.

For the purposes of the present invention, the at least three consecutive repeat units form a polymeric constituent. The polymeric constituent may be covalently bound to the chromophore group, directly or indirectly via a linking group. Examples of suitable polymeric constituents include polyoxyalkylene chains having multiple repeating units. In one aspect, the polymeric constituents include polyoxyalkylene chains having from 2 to about 30 repeating units, from 2 to about 20 repeating units, from 2 to about 10 repeating units or even from about 3 or 4 to about 6 repeating units. Non-limiting examples of polyoxyalkylene chains include ethylene oxide, propylene oxide, glycidol oxide, butylene oxide and mixtures thereof.

<u>Surfactants</u> - The compositions according to the present invention may comprise a surfactant or surfactant system wherein the surfactant can be selected from nonionic surfactants, anionic surfactants, cationic surfactants, ampholytic surfactants, zwitterionic surfactants, semi-polar nonionic surfactants and mixtures thereof.

The surfactant is typically present at a level of from about 0.01% to about 60%, from about 0.1% to about 60%, from about 1% to about 50% or even from about 5% to about 40% by weight of the subject composition. Alternatively, the surfactant may be present at a level of from about 0.01% to about 60%, from about 0.01% to about 50%, from about 0.01% to about 40%, from about 0.1% to about 25%, from about 1% to about 10%, by weight of the subject composition.

Chelating Agents - The compositions herein may contain a chelating agent. Suitable chelating agents include copper, iron and/or manganese chelating agents and mixtures thereof. When a chelating agent is used, the composition may comprise from about 0.1% to about 15% or even from about 3.0% to about 10% chelating agent by weight of the subject composition.

Dye Transfer Inhibiting Agents - The compositions of the present invention may also include one or more dye transfer inhibiting agents. Suitable polymeric dye transfer inhibiting agents include, but are not limited to, polyvinylpyrrolidone polymers, polyamine N-oxide polymers, copolymers of N-vinylpyrrolidone and N-vinylimidazole, polyvinyloxazolidones and polyvinylimidazoles or mixtures thereof.

When present in a subject composition, the dye transfer inhibiting agents may be present at levels from about 0.0001% to about 10%, from about 0.01% to about 5% or even from about 0.1% to about 3% by weight of the composition.

Dispersants - The compositions of the present invention can also contain dispersants. Suitable water-soluble organic materials include the homo- or co-polymeric acids or their salts, in which the polycarboxylic acid comprises at least two carboxyl radicals separated from each other by not more than two carbon atoms.

Perfumes – The dispersed phase may comprise a perfume that may include materials selected from the group consisting of perfumes such as 3-(4-*t*-butylphenyl)-2-methyl propanal, 3-(4-*t*-butylphenyl)-propanal, 3-(4-isopropylphenyl)-2-methylpropanal, 3-(3,4-methylenedioxyphenyl)-2-methylpropanal, and 2,6-dimethyl-5-heptenal, alpha-damascone, beta-damascone, gamma-damascone, beta-damascenone, 6,7-dihydro-1,1,2,3,3-pentamethyl-4(5H)-indanone, methyl-7,3-dihydro-2H-1,5-benzodioxepine-3-one, 2-[2-(4-methyl-3-cyclohexenyl-1-yl)propyl]cyclopentan-2-one, 2-sec-butylcyclohexanone, and beta-dihydro ionone, linalool, ethyllinalool, tetrahydrolinalool, and dihydromyrcenol.

Perfume Delivery Technologies - The fluid fabric enhancer compositions may comprise one or more perfume delivery technologies that stabilize and enhance the deposition and release of perfume ingredients from treated substrate. Such perfume delivery technologies can also be used to increase the longevity of perfume release from the treated substrate. Perfume delivery technologies, methods of making certain perfume delivery technologies and the uses of such perfume delivery technologies are disclosed in US 2007/0275866 A1.

In one aspect, the fluid fabric enhancer composition may comprise from about 0.001% to about 20%, or from about 0.01% to about 10%, or from about 0.05% to about 5%, or even from about 0.1% to about 0.5% by weight of the perfume delivery technology. In one aspect, said perfume delivery technologies may be selected from the group consisting of: perfume microcapsules, pro-perfumes, polymer particles, functionalized silicones, polymer assisted delivery, molecule assisted delivery, fiber assisted delivery, amine assisted delivery, cyclodextrins, starch encapsulated accord, zeolite and inorganic carrier, and mixtures thereof:

In one aspect, said perfume delivery technology may comprise microcapsules formed by at least partially surrounding a benefit agent with a wall material. Said benefit agent may include materials selected from the group consisting of perfumes such as 3-(4-*t*-butylphenyl)-2-methyl propanal, 3-(4-*t*-butylphenyl)-propanal, 3-(4-isopropylphenyl)-2-methylpropanal, 3-(3,4-methylenedioxyphenyl)-2-methylpropanal, and 2,6-dimethyl-5-heptenal, α-damascone, β-damascone, δ-damascone, β-damascenone, 6,7-dihydro-1,1,2,3,3-pentamethyl-4(5H)-indanone, methyl-7,3-dihydro-2H-1,5-benzodioxepine-3-one, 2-[2-(4-methyl-3-cyclohexenyl-1-yl)propyl]cyclopentan-2-one, 2-sec-butylcyclohexanone, and β-dihydro ionone, linalool, ethyllinalool, tetrahydrolinalool, and dihydromyrcenol; silicone oils, waxes such as polyethylene waxes; essential oils such as fish oils, jasmine, camphor, lavender; skin coolants such as menthol, methyl lactate; vitamins such as Vitamin A and E; sunscreens; glycerine; catalysts such as manganese catalysts or bleach catalysts; bleach particles such as perborates; silicon dioxide particles; antiperspirant actives; cationic polymers and mixtures thereof. Suitable benefit agents can be obtained from Givaudan Corp. of Mount Olive, New Jersey, USA, International Flavors & Fragrances Corp. of South Brunswick, New Jersey, USA, orFirmenich Company of Geneva, Switzerland. In one aspect, the microcapsule wall material may comprise: melamine, polyacrylamide, silicones, silica, polystyrene, polyurea, polyurethanes, polyacrylate based materials, gelatin, styrene malic anhydride, polyamides, and mixtures thereof. In one aspect, said melamine wall material may comprise melamine crosslinked with formaldehyde, melamine-dimethoxyethanol crosslinked with formaldehyde, and mixtures thereof. In one aspect, said polystyrene wall material may comprise polyestyrene cross-linked with divinylbenzene. In one aspect, said polyurea wall material may comprise urea crosslinked with formaldehyde, urea crosslinked with gluteraldehyde, polyisocyanate reacted with a polyamine, a polyamine reacted with an aldehyde, and mixtures thereof. In one aspect, said polyacrylate based materials may comprise polyacrylate formed from methylmethacrylate/dimethylaminomethyl methacrylate, polyacrylate formed from amine acrylate and/or methacrylate and strong acid, polyacrylate formed from carboxylic acid acrylate and/or methacrylate monomer and strong base, polyacrylate formed from an amine acrylate and/or methacrylate monomer and a carboxylic acid acrylate and/or carboxylic acid methacrylate monomer, and mixtures thereof. In one aspect, the perfume microcapsule may be coated with a deposition aid, a cationic polymer, a non-ionic polymer, an anionic polymer, or mixtures thereof. Suitable polymers may be selected from the group consisting of: polyvinylformaldehyde, partially hydroxylated polyvinylformaldehyde, polyvinylamine, polyethyleneimine, ethoxylated polyethyleneimine, polyvinylalcohol, polyacrylates, and combinations thereof. In one aspect, one or more types of microcapsules, for example two microcapsules types having different perfume benefit agents may be used.

In one aspect, said perfume delivery technology may comprise an amine reaction product (ARP) or a thiol reaction product. One may also use "reactive" polymeric amines and or polymeric thiols in which the amine and/or thiol functionality is pre-reacted with one or more PRMs to form a reaction product. Typically the reactive amines are primary and/or secondary amines, and may be part of a polymer or a monomer (non-polymer). Such ARPs may also be mixed with additional PRMs to provide benefits of polymer-assisted delivery and/or amine-assisted delivery. Nonlimiting examples of polymeric amines include polymers based on polyalkylimines, such as polyethyleneimine (PEI), or polyvinylamine (PVAm). Nonlimiting examples of monomeric (non-polymeric) amines include hydroxyl amines, such as 2-aminoethanol and its alkyl substituted derivatives, and aromatic amines such as anthranilates. The ARPs may be premixed with perfume or added separately in leave-on or rinse-off applications. In another aspect, a material that contains a heteroatom other than nitrogen and/or sulfur, for example oxygen, phosphorus or selenium, may be used as an alternative to amine compounds. In yet another aspect, the aforementioned alternative compounds can be used in combination with amine compounds. In yet another aspect, a single molecule may comprise an amine moiety and one or more of the alternative heteroatom moieties, for example, thiols, phosphines and selenols. The benefit may include improved delivery of perfume as well as controlled perfume release. Suitable ARPs as well as methods of making same can be found in USPA 2005/0003980 A1 and USP 6,413,920 B1.

<u>Processes of Making Products</u>

The compositions of the present invention can be formulated into any suitable form and prepared by any process chosen by the formulator, non-limiting examples of which are described in Applicants examples and in US 2013/0109612 A1 which is incorporated herein by reference.

In one aspect, the compositions disclosed herein may be prepared by combining the components thereof in any convenient order and by mixing, e.g., agitating, the resulting component combination to form a phase stable fabric and/ or home care composition. In one aspect, a fluid matrix may be formed containing at least a major proportion, or even substantially all, of the fluid components with the fluid components being thoroughly admixed by imparting shear agitation to this liquid combination. For example, rapid stirring with a mechanical stirrer may be employed.

<u>Method of Use</u>

The compositions of the present invention may be used in any conventional manner. In short, they may be used in the same manner as products that are designed and produced by conventional methods and processes. For example, compositions of the present invention can be used to treat a situs inter alia a surface or fabric. Typically at least a portion of the situs is contacted with an aspect of Applicants' composition, in neat form or diluted in a wash liquor, and then the situs is optionally washed and/or rinsed. For purposes of the present invention, washing includes but is not limited to, scrubbing, and mechanical agitation. The fabric may comprise any fabric capable of being laundered in normal consumer use conditions. When the wash solvent is water, the water temperature typically ranges from about 5 °C to about 90 °C and, when the situs comprises a fabric, the water to fabric mass ratio is typically from about 1:1 to about 100:1. The consumer products of the present invention may be used as liquid fabric enhancers wherein they are applied to a fabric and the fabric is then dried via line drying and/or drying the an automatic dryer.

In the examples, the following abbreviations are used:

Monomers

ACM	acrylamide
DMA3*MeCl	2-trimethylammoniumethyl acrylate chloride or 2-(acryloyloxy)ethyl]trimethylammonium chloride
DMAEMA*MeCl	2-trimethylammoniumethyl methacrylate chloride

BEM	behenyl-25 methacrylate
MBA	methylene-bis-acrylamide (crosslinker)
TAAC	tetraallyl-ammonium chloride (crosslinker)
PETIA	pentaerythrityl tri/tetraacrylate (crosslinker)
TMPTA EOx	trimethylolpropane tris(polyethylene glycol ether) triacrylate (TMPTA EOx) (crosslinker)
NaHP	sodium hypophosphite (chain transfer agent)
C16EO25MAc	C_{16}-C_{18}-fatty alcohol-(ethylene glycol)$_{25}$ ether methacrylate
Others	
pphm	parts per hundred parts of monomers

Examples

General test methods

Unless stated otherwise, the following general test methods are used in the examples which follow:

Determination of viscosity in aqueous media

With reference to the methods according to DIN 51550, DIN 53018, DIN 53019, the Brookfield model DV II viscometer is used, unless stated otherwise within the following tables, at the speed of 10 or 60 revolutions per minute with the specified spindle no. 2, 3 or 6 to measure the viscosities reported in mPas.

Determination of viscosity at 25°C of 1wt% aqueous solution product (approximately 50wt% active polymer) - Brookfield viscosity is measured using a Brookfield DVII -fitted with a spindle 3 at 10rpm. The test is conducted in deionised water at 25°C. Initial viscosity is defined as the Brookfield viscosity measured within 35 minutes of making the sample.

Determination of viscosity at 25°C of an aqueous solution containing 0,4wt% product (approximatively 50wt% active polymer) and 100ppm calcium chloride - Brookfield viscosity is measured using a Brookfield DVII - fitted with a spindle 2 at 60rpm. The test is conducted in

100ppm calcium chloride solution in deionised water at 25°C. Initial viscosity is defined as the Brookfield viscosity measured within 2 hours of making the sample.

Assessing Phase and Brookfield viscosity stability

Brookfield viscosity is measured using a Brookfield DV-E viscometer fitted with a LV2 spindle at 60 RPM. The test is conducted in accordance with the instrument's instructions. Initial viscosity is defined as the Brookfield viscosity measured within 24 hours of making the sample. Samples are stored in glass jars with a screw cap lid and aged undisturbed in a constant temperature room maintained at 35 °C. Physical stability is assessed by visual observation of the product in the undisturbed glass jar. Products are deemed stable when no clear layer is observed at the bottom of the jar. Products are deemed unstable when a clear layer is observed at the bottom of the jar. Brookfield viscosity of the aged sample is measured after tipping the jar by hand to homogenize the sample.

Viscosity slope method 1

The viscosity slope value quantifies the rate at which the viscosity increases as a function of increasing polymer concentration. The viscosity slope of a single polymer or of a dual polymer system is determined from viscosity measurements conducted on a series of aqueous solutions which span a range of polymer concentrations. Acidified water is prepared gravimetrically by adding about 0.1 ppm hydrochloric acid to deionized water. A series of aqueous polymer solutions are prepared to logarithmically span between 0.01 and 1 polymer weight percent of the polymer in said acidic water. Each polymer solvent solutions is prepared gravimetrically by mixing the polymer and solvent with a SpeedMixer DAC 150 FVZ-K (made by FlackTek Inc. of Landrum, South Carolina) for 1 minute at 2,500 RPM in a Max 60 cup or Max 100 cup to the target polymer weight percent of the aqueous polymer solution. Viscosity as a function of shear rate of each polymer solvent solutions is measured at 40 different shear rates using an Anton Paar Rheometer with a DSR 301 measuring head and concentric cylinder geometry. The time differential for each measurement is logarithmic over the range of 180 and 10 seconds and the shear rate range for the measurements is 0.001 to 500 1/seconds (measurements taken from the low shear rate to the high shear rate).

Viscosities 0.2 Pa s and greater at a shear rate of 0.01 1/seconds as a function of polymer weight percent of the aqueous polymer solvent solution was fit using the equation $Y = bX^a$ wherein X was the polymer concentration in the solvent polymer solution, Y was the polymer solvent solution viscosity, b was the extrapolated solvent polymer solution viscosity when X is extrapolated to one weight percent and the exponent a is the polymer concentration viscosity scaling power, here defined as the viscosity slope, over the polymer concentration range where the exponent a is the highest value.

Viscosity Slope Method 2

The viscosity slope value quantifies the rate at which the viscosity increases as a function of increasing polymer concentration. The viscosity slope of a single polymer or of a dual polymer system is determined from viscosity measurements conducted on a series of aqueous solutions which span a range of polymer concentrations and which are termed polymer solvent solutions. Viscosity analyses are conducted using an Anton Paar Dynamic Shear Rheometer model DSR 301 Measuring Head, equipped with a 32-place Automatic Sample Changer (ASC) with reusable metal concentric cylinder geometry sample holders, and Rheoplus software version 3.62 (all from Anton Paar GmbH., Graz, Austria). All polymer solutions are mixed using a high-speed motorized mixer, such as a Dual Asymmetric Centrifuge SpeedMixer model DAC 150 FVZ-K (FlackTek Inc., Landrum, South Carolina, USA) or equivalent.

The aqueous phase diluent for all of the aqueous polymer solutions is prepared by adding sufficient concentrated hydrochloric acid (e.g. 16 Baume, or 23% HCl) to deionized water until a pH of about 3.0 is achieved. The polymer(s) are combined with the aqueous phase diluent in a mixer cup (such as the Flacktek Speedmixer Max 100 or Max 60) that is compatible with the mixer to be used and is of a suitable size to hold a sample volume of 35 mL to 100 mL. Sufficient polymer is added to the aqueous phase diluent to achieve a concentration of between 8000 - 10000 ppm of the single polymer, or of the polymer 2 in the case of a dual polymer system, and to yield a volume of between 35 mL to 100 mL. The mixture of the polymer(s) and the aqueous phase is mixed for 4 minutes at a speed of 3500 RPM. After mixing, this initial polymer solvent solution is put aside to rest in a sealed container for at least 24 hours.

A single viscosity measurement is obtained from each of 32 polymer solvent solutions wherein each solution has a different concentration of polymer. These 32 polymer solvent solutions comprise a series of solutions that span the concentration range of 1000 ppm to 4000 ppm, with the solutions spaced at concentration intervals of approximately every 100 ppm. Each of the 32 polymer solvent solution concentrations is prepared gravimetrically by mixing the initial 8000 - 10000 ppm polymer solvent solution with sufficient additional aqueous phase diluent to result in a solution having the required target concentration and a volume of 35 mL to 100 mL, which is then mixed for 2 minutes at a speed of 3500 RPM. All of the resultant polymer solvent solutions are put aside to rest in a sealed cup for at least 24 hours. Polymer solutions are loaded into the concentric cylinder sample holders of the rheometer's ASC, using a pipette to fill each cylinder up to the line indicating a volume of 23 mL. The samples are stored in the ASC of the rheometer at a temperature of approximately 21 °C for up to 36 hours until measured. The viscosity of each of the 32 polymer solvent solutions is measured at the shear rate of 0.0105 1/s, and the viscosity value in units of Pa·s is recorded as soon as the value being measured is stable and consistent.

The recorded viscosity values measured at a shear rate of 0.0105 1/s are paired with the value of the respective concentration of the polymer solvent solution measured. The resultant paired data values are plotted as 32 data points on a graph with viscosity in units of Pa·s on the x-axis, and polymer concentration in units of ppm on the y-axis. This data set is subsampled repeatedly to yield 30 subsets, wherein each subset comprises three consecutive data points. The subset creation process begins with the data point at the lowest polymer concentration and advances in sequence increasing toward the highest polymer concentration, until 30 unique subsets have been created. The subset creation process advances up to higher concentrations in steps of 1 data point at a time.

The three data points in each subset are fit with the following linear equation, using linear least squares regression, to determine the value of the exponent "a" for each of the 30 subsets:

$$Y = bX^a$$

wherein;

X is the polymer concentration in the solvent polymer solution (in ppm),

Y is the polymer solvent solution viscosity (in Pa·s)

b is the extrapolated solvent polymer solution viscosity (in Pa·s) when X is extrapolated to the value of 1 ppm,

and the exponent a is a unitless parameter.

The Viscosity Slope value reported for the material being tested is the highest value calculated for the exponent "a", of all of the 30 values calculated for the exponent "a" from the 30 subsets.

Use of the inventive polymers in standard formulation of fabric softeners

W3: Preparation of a methyltris(hydroxyethyl)ammonium ditallow fatty acid ester methylsulfate, partly hydrogenated, fabric softener (active content 5.5%)

The fabric softener formulation has a pH of 2.7 and comprises 5.5% by weight of methyltris(hydroxyethyl)ammonium ditallow fatty acid ester methylsulfate (partly hydrogenated) and 94.5% by weight of demineralized water.

Addition of 1wt% dispersion (approximately 50wt% active polymer) to fabric softener formulations W3.

The thickener is added gradually at room temperature to the particular fabric softener formulation and stirred until the formulation has homogenized.
The Brookfield viscosity is measured 2h after the preparation using the Brookfield model DV II viscometer at the speed of 10 revolutions per minute with the specified spindle no.6 reported in mPas. The results are compiled in Table 2.

Determination of the soluble and insoluble parts of the monomer using the analytical ultracentrifuge (AUC)

For the characterization of soluble (non cross-linked) and insoluble (cross-linked) parts of the polymer, fractionation experiments using Analytical Ultracentrifugation (AUC) were performed. Sedimentation velocity runs were recorded using a Beckman Optima XL-I (Beckman Instruments, Palo Alto, USA) with interference optical detection system (wavelength 675 nm).
The samples have been measured at polymer concentrations of 0.1 g/l in 0.1M $NaNO_3$. The centrifugation speed was varied between 1000 rpm and 45,000 rpm.
The concentration of sedimenting fractions was determined using a standard analysis Software (SEDFIT) using the density and viscosity of the solvent, and a specific refractive index increment of the polymer. The absolute deviation for the determination of the soluble polymer weight fraction expressed in % is 3%. The weight percent of soluble polymer is the AUC value.

The method for determining Weight Percent Water Soluble Fraction above should provide the same Weight Percent Water Soluble Fraction as the method provided below if such method is properly executed, as the method provided above (with reference) is a more detailed version of the method below. Thus, when determining Weight Percent Water Soluble Fraction, it is preferred that the method above be used.

For the determination of soluble and insoluble parts of the polymer, fractionation experiments using Analytical ultracentrifugation were performed. Sedimentation velocity runs using a Beckman Optima XL-I (Beckman Instruments, Palo Alto, USA) with interference optical detection system (wavelength 675 nm) was used. The samples have been measured at polymer concentrations below critical polymer overlap concentration using salt solution to insure polyelectrolyte screening effect. The centrifugation speed was varied between 1000 rpm and 45,000 rpm.

The sedimentation coefficient, defined as a median value for each fraction, and the concentration of one sedimenting fraction were determined using a standard analysis Software (SEDFIT) using the density and viscosity of the solvent, and a specific refractive index increment of the polymer. The sedimentation coefficient is in units of Sved (1Sved = 10^{-13} seconds). The standard deviation for the determination of weight fraction and sedimentation coefficients of water soluble and crosslinked water-swellable polymers is 3%, 10% and up to 30% respectively. The weight percent of soluble polymer is the AUC value.

Fabric and Test Swatch Preparation Method

Fabrics are assessed under NA Top Load wash conditions using Kenmore FS 600 and/or 80 series washer machines. Wash Machines are set at: 32°C/15°C wash/rinse temperature, 6 gpg hardness, normal cycle, and medium load (64 liters). Fabric bundles consist of 2.5 kilograms of clean fabric consisting of 100% cotton. Test swatches are included with this bundle and comprise of 100% cotton Euro Touch terrycloth towels (purchased from Standard Textile, Inc. Cincinnati, OH). Bundles are stripped according to the Fabric Preparation-Stripping and Desizing procedure before running the test. Tide Free liquid detergent (1x recommended dose) is added under the surface of the water after the machine is at least half full. Once the water stops flowing and the washer begins to agitate, the clean fabric bundle is added. When the machine is almost full with rinse water, and before agitation has begun, the fabric care testing composition is slowly added (1x dose), ensuring that none of the fabric care testing composition comes in direct contact with the test swatches or fabric bundle. When the wash/rinse cycle is complete, each wet fabric bundle is transferred to a corresponding dryer. The dryer used is a Maytag commercial series (or equivalent) dryer, with the timer set for 55 minutes on the cotton/high heat/timed dry setting. This process is repeated for a total of three (3) complete wash-dry cycles. After the third drying cycle and once the dryer stops, 12 Terry towels from each fabric bundle are removed for actives deposition analysis. The fabrics are then placed in a constant Temperature/Relative Humidity (21°C, 50% relative humidity) controlled grading room for 12-24 hours and then graded for softness and/or actives deposition.

The Fabric Preparation-Stripping and Desizing procedure includes washing the clean fabric bundle (2.5 kg of fabric comprising 100% cotton) including the test swatches of 100% cotton EuroTouch terrycloth towels for 5 consecutive wash cycles followed by a drying cycle. AATCC (American Association of Textile Chemists and Colorists) High Efficiency (HE) liquid detergent is used to strip/de-size the test swatch fabrics and clean fabric bundle (1x recommended dose per wash cycle). The wash conditions are as follows: Kenmore FS 600 and/or 80 series wash machines (or equivalent), set at: 48°C/48°C wash/rinse temperature, water hardness equal to 0 gpg, normal wash cycle, and medium sized load (64 liters). The dryer timer is set for 55 minutes on the cotton/high/timed dry setting.

Silicone Measurement Method

Silicone is extracted from approximately 0.5 grams of fabric (previously treated according to the test swatch treatment procedure) with 12 mL of either 50:50 toluene:methylisobutyl ketone or 15:85 ethanol:methylisobutyl ketone in 20 mL scintillation vials. The vials are agitated on a pulsed vortexer for 30 minutes. The silicone in the extract is quantified using inductively coupled plasma optical emission spectrometry (ICP-OES). ICP calibration standards of known silicone concentration are made using the same or a structurally comparable type of silicone raw material as the products being tested. The working range of the method is 8 – 2300 μg silicone per gram of fabric. Concentrations greater than 2300 μg silicone per gram of fabric can be assessed by subsequent dilution. Deposition efficiency index of silicone is determined by calculating as a percentage, how much silicone is recovered, via the aforementioned measurement technique, versus how much is delivered via the formulation examples. The analysis is performed on terrycloth towels (EuroSoft towel, sourced from Standard Textile, Inc, Cincinnati, OH) that have been treated according to the wash procedure outlined herein.

Stabilizing agents used in the examples

Stabilizing agent A (nonionic block copolymer): Polyglyceryl-dipolyhydroxystearate with CAS-Nr. 144470-58-6.

Stabilizing agent B is a nonionic ABA-block copolymer with molecular weight of about 5000g/mol, and a hydrophobic lipophilic balance value (HLB) of 5 to 6, wherein the A block is based on polyhydroxystearic acid and and the B block on polyalkylene oxide.

Stabilizing agent C (nonionic block copolymer): PEG-30 Dipolyhydroxystearate, with CAS-Nr. 70142-34-6

Stabilizing agent D (nonionic block copolymer): Alcyd Polyethylenglycol Poly-isobutene stabilizing surfactant with HLB 5-7

Comparative Example 1 (CE1)

Synthesis of the cationic polymer

An aqueous phase of water soluble components is prepared by admixing together the following components:

1.23 g (0,5 pphm) of citric acid-1-hydrate,

0.7 g (0.29 pphm) of a aqueous solution of pentasodium diethylenetriaminepentaacetate,

43.78 g (17.85 pphm) of water,

29,56 g (0.12 pphm) of methylene-bis-acrylamide (1% aqueous solution),

8.0 g (0.02 pphm) of sodium hypophosphite (5% aqueous solution), and

326.66 g (100.0 pphm) of methyl chloride quaternised dimethylaminoethylmethacrylate.

An oil phase is prepared by admixing together the following components:

8.0 g (2.45 pphm) of sorbitan tri-oleate (75% in dearomatized aliphatic hydrocarbon) point betwen 160°C till 190°C.

67.8 g (5.22 pphm) of a polymeric stabilizer (stearyl methacrylate-methacrylic acid copolymer: (18.87% in solvent)

151.29 g (61.75 pphm) of 2-ethylhexyl stearate, and

60.2 g (24.57 pphm) of dearomatised hydrocarbon solvent with a boiling point betwen 160°C till 190°C.

The two phases are mixed together in a ratio of 41.8 parts oil phase to 58.2 parts aqueous phase under high shear to form a water-in-oil emulsion. The resulting water-in-oil emulsion is transferred to a reactor equipped with nitrogen sparge tube, stirrer and thermometer. The emulsion is purged with nitrogen to remove oxygen.

Polymerisation is effected by addition of a redox couple of sodium metabisulphite and tertiary butyl hydroperoxide stepwise such that is a temperature increase of 2°C/min.
Once the isotherm has been attained, a free radical initiator (2,2'-azobis(2-methylbutyronitrile), CAS: 13472-08-7) is added in two steps (the 2nd step after 45 min) and the emulsion is kept at 85°C for 75 minutes.

Vacuum distillation is carried out to remove water and volatile solvent to give a final product of 50% polymer solids.
To this product addition is made of 34.3 g (14.0 pphm) of a fatty alcohol alkoxylate [alcohol C_6-C_{17}(secondary) poly(3-6)ethoxylate: 97% secondary alcohol ethoxylate + 3% poly(ethylene oxide)], (CAS No. 84133-50-6).

Comparison 2 (CE2)

Synthesis of the cationic polymer
This example iIlustrates the preparation of a suitable cationic polymer.
An aqueous phase of water soluble components is prepared by admixing together the following components:
1.88 g (0.5 pphm) of citric acid-1-hydrate,
1.07 g 0.29 pphm) of a aqueous solution of pentasodium diethylenetriaminepentaacetate,
220.37 g (58.77 pphm) of water,
3.75 g (0.01 pphm) of methylene-bis-acrylamide (1% aqueous solution),
0.75 g (0.2 pphm) of formic acid
281.25 g (60.0 pphm) of methyl chloride quaternised dimethylaminoethylacrylate (DMA3*MeCl 80% aqueous solution), and
300.00 g (40.0 pphm) of acrylamide (50% aqueous solution).

An oil phase is prepared by admixing together the following components:

12.245 g (2.45 pphm) of sorbitan tri-oleate (75% in dearomatized aliphatic hydrocarbon) point betwen 160°C till 190°C.

103.825 g (5.22 pphm) of a polymeric stabiliser, stearyl methacrylate-methacrylic acid copolymer (18.87% in solvent)

259.14 g (69.1 pphm) of 2-ethylhexyl stearate, and

99.97 g (26.66 pphm) of dearomatised hydrocarbon solvent with a boiling point betwen 160°C till 190°C.

The two phases are mixed together in a ratio of 37 parts oil phase to 63 parts aqueous phase under high shear to form a water-in-oil emulsion. The resulting water-in-oil emulsion is transferred to a reactor equipped with nitrogen sparge tube, stirrer and thermometer. 0.21g (0.056 pphm) 2,2-azobis(2-methylbutyronitril) is added and the emulsion is purged with nitrogen to remove oxygen.

Polymerisation is effected by addition of a redox couple of sodium metabisulphite and tertiary butyl hydroperoxide stepwise such that is a temperature increase of 2°C/min. After the isotherm is completed the emulsion held at 85°C for 60 minutes. Then residual monomer reduction with 72.7 g (0.25 pphm) tertiary butyl hydroperoxide (1.29% in solvent) and 82.2 g (0.25 pphm) sodium metabisulphite (1.14% in emulsion) is started (3 hours feeding time).

Vacuum distillation is carried out to remove water and volatile solvent to give a final product, i.e. a dispersion containing 50% polymer solids.

To this product addition is made of 52.5 g (14.0 pphm) of a fatty alcohol alkoxylate [alcohol C6-C17(secondary) poly(3-6)ethoxylate: 97% secondary alcohol ethoxylate + 3% poly(ethylene oxide)], (CAS No. 84133-50-6)..

Example 1

Using compound B for the cationic polymers and stabilizing agents, wherein the stabilizing agent has one or more hydrophobic chains with more than 30 carbon atoms to get enhanced soluble polymer part and improved deposition and enhanced stability.

Synthesis of the cationic polymer

This example iIlustrates the preparation of a suitable cationic polymer.

An aqueous phase of water soluble components is prepared by admixing together the following components:

2.26 g (0.5 pphm) of citric acid-1-hydrate,

2.25 g (0.2 pphm) of a aqueous solution (40%) of pentasodium diethylenetriaminepentaacetate,

179.91 g (39.98 pphm) of water,

0.90 g (0.2 pphm) of formic acid (Chain transfer agent)

337.5 g (60.0 pphm) of methyl chloride quaternised dimethylaminoethylacrylate (DMA3*MeCl, 80% aqueous solution), and

360.00 g (40.0 pphm) of acrylamide (50% aqueous solution).

An oil phase is prepared by admixing together the following components:

73.47 g (2.45 pphm) of stabilizing agent B (15% in solvent) as stabilizing surfactant,

124.58 g (5.22 pphm) of a polymeric stabiliser stearyl methacrylate-methacrylic acid copolymer (18.87% in solvent),

354.15 g (78.7 pphm) of 2-ethylhexyl stearate, and

105.93 g (23.54 pphm) of dearomatised hydrocarbon solvent with a boiling point betwen 160°C till 190°C.

4.50g (0.01pphm) Pentaerythrityl tri/tetraacrylate (PETIA) (1% i-Propanol solution).

The two phases are mixed together in a ratio of 43 parts oil phase to 57 parts aqueous phase under high shear to form a water-in-oil emulsion. The resulting water-in-oil emulsion is transferred to a reactor equipped with nitrogen sparge tube, stirrer and thermometer. 0.11g (0.025 pphm) 2,2-Azobis(2-methylbutyronitril)is added and the emulsion is purged with nitrogen to remove oxygen.

Polymerisation is effected by addition of a redox couple of sodium metabisulphite and tertiary butyl hydroperoxide (one shot: 2.25g(1% in solvent / 0,005pphm) stepwise such that is a temperature increase of 1.5°C/min. After the isotherm is completed the emulsion held at 85°C for 60 minutes. Then residual monomer reduction with 18.25 g (0.25 pphm) tertiary butyl hydroperoxide (6.16% in solvent) and 21.56 g (0.25 pphm) sodium metabisulphite (5.22% in emulsion) is started (1.5 hours feeding time).

Vacuum distillation is carried out to remove water and volatile solvent to give a final product, i.e. a dispersion containing 50% polymer solids.

To this product addition is made of 63.0g (14.0 pphm) of a fatty alcohol alkoxylate [alcohol C_6-C_{17}(secondary) poly(3-6)ethoxylate: 97% secondary alcohol ethoxylate + 3% poly(ethylene oxide)], (CAS No. 84133-50-6).

Examples 1.1 to 1.11 in Table 1 are prepared according to the same process as the one described above for example 1.

Example 2

An aqueous phase of water soluble components is prepared by admixing together the following components:

2.26 g (0.5 pphm) of citric acid-1-hydrate,

2.25 g (0.2 pphm) of an aqueous solution (40%) of pentasodium diethylenetriaminepentaacetate,

170.55 g (37.90 pphm) of water,

9.00 g (0.10pphm) of tetraallylammonium chloride (TAAC) (5% aqueous solution)

0.90 g (0.2 pphm) of formic acid

337.5 g (60.0 pphm) of methyl chloride quaternised dimethylaminoethylacrylate (DMA3*MeCl 80% aqueous solution), and

360.00 g (40.0 pphm) of acrylamide (50% aqueous solution).

An oil phase is prepared by admixing together the following components:

73.47 g (2.45 pphm) of stabilizing agent B (15% in solvent) as stabilizing surfactant,

124.58 g (5.22 pphm) of a polymeric stabiliser stearyl methacrylate-methacrylic acid copolymer (18.87% in solvent),

354.15 g (78.7 pphm) of 2-ethylhexyl stearate, and

111.65 g (24.81 pphm) of dearomatised hydrocarbon solvent with a boiling point betwen 160°C till 190°C.

The two phases are mixed together in a ratio of 43 parts oil phase to 57 parts aqueous phase under high shear to form a water-in-oil emulsion. The resulting water-in-oil emulsion is transferred to a reactor equipped with nitrogen sparge tube, stirrer and thermometer. 0.11g (0.025 pphm)

2,2-azobis(2-methylbutyronitril) is added and the emulsion is purged with nitrogen to remove oxygen.

Polymerisation is effected by addition of a redox couple of sodium metabisulphite and tertiary butyl hydroperoxide (one shot: 2.25g (1% in solvent / 0,005pphm)) stepwise such that is a temperature increase of 1.5°C/min. After the isotherm is completed the emulsion held at 85°C for 60 minutes. Then residual monomer reduction with 18.25 g (0.25 pphm) tertiary butyl hydroperoxide (6.16% in solvent) and 21.56 g (0.25 pphm) sodium metabisulphite (5.22% in emulsion) is started (1.5 hours feeding time).

Vacuum distillation is carried out to remove water and volatile solvent to give a final product, i.e. a dispersion containing 50% polymer solids.
To this product addition is made of 63.0g (14.0 pphm) of a fatty alcohol alkoxylate [alcohol C_6-C_{17}(secondary) poly(3-6)ethoxylate: 97% secondary alcohol ethoxylate + 3% poly(ethylene oxide)], (CAS No. 84133-50-6).

Examples 2.1 to 2.22 in Table 1 are prepared according to the same process as the one described above for example 2.

Example 3

An aqueous phase of water soluble components is prepared by admixing together the following components:
2.26 g (0.5 pphm) of citric acid-1-hydrate,
2.25 g (0.2 pphm) of an aqueous solution (40%) of pentasodium diethylenetriaminepentaacetate,
170.55 g (37.90 pphm) of water,
9.00g (0.10pphm) of Trimethylolpropane tris(polyethylene glycol ether) triacrylate (TMPTA EOx) (5% aqueous solution)
0.90 g (0.2 pphm) of formic acid
337.50 g (60.0 pphm) of methyl chloride quaternised dimethylaminoethylacrylate (DMA3*MeCl 80% aqueous solution), and
360.00 g (40.0 pphm) of acrylamide (50% aqueous solution).

An oil phase is prepared by admixing together the following components:

73.47 g (2.45 pphm) of stabilizing agent B (15% in solvent) as stabilizing surfactant,

124.58 g (5.22 pphm) of a polymeric stabiliser stearyl methacrylate-methacrylic acid copolymer (18.87% in solvent),

354.15 g (78.7 pphm) of 2-ethylhexyl stearate, and

111.65 g (24.81 pphm) of dearomatised hydrocarbon solvent with a boiling point betwen 160°C till 190°C.

The two phases are mixed together in a ratio of 43 parts oil phase to 57 parts aqueous phase under high shear to form a water-in-oil emulsion. The resulting water-in-oil emulsion is transferred to a reactor equipped with nitrogen sparge tube, stirrer and thermometer. 0.11g (0.025 pphm) 2,2-Azobis(2-methylbutyronitril)is added and the emulsion is purged with nitrogen to remove oxygen.

Polymerisation is effected by addition of a redox couple of sodium metabisulphite and tertiary butyl hydroperoxide (one shot: 2.25g (1% in solvent / 0,005pphm) stepwise such that is a temperature increase of 1.5°C/min. After the isotherm is completed the emulsion held at 85°C for 60 minutes. Then residual monomer reduction with 18.25 g (0.25 pphm) tertiary butyl hydroperoxide (6.16% in solvent) and 21.56 g (0.25 pphm) sodium metabisulphite (5.22% in emulsion) is started (1.5 hours feeding time).

Vacuum distillation is carried out to remove water and volatile solvent to give a final product, i.e. a dispersion containing 50% polymer solids.

To this product addition is made of 63.0g (14.0 pphm) of a fatty alcohol alkoxylate [alcohol C_6-C_{17}(secondary) poly(3-6)ethoxylate: 97% secondary alcohol ethoxylate + 3% poly(ethylene oxide)], (CAS No. 84133-50-6).

Example 3.1 in Table 1 is prepared according to the same process as the one described above for example 3.

Table 1: Examples of Polymer 1

Example	Stabilizing agent B (pphm)	DMA3* MeCl (pphm)	Acryl amide (pphm)	Methy-len bis acryl-amide (pphm)	PETIA (pphm)	TAAC (pphm)	TMPTA-EOx (pphm)	Chain transfer agent (pphm)	Reaction-speed °C/min.
P1.1	2.45	60	40		0.01			0.2	+1.5
P1.1.1	2.45	60	40		0.05			0.2	+1.5
P1.1.2	2.45	60	40		0.035			0.2	+1.5
P1.1.3	2.45	60	40		0.035			0.2	+1.5
P1.1.4	2.45	60	40		0.035			0.2	+1.5
P1.1.5	2.45	60	40		0.035			0.2	+1.5
P1.1.6	2.45	60	40		0.035			0.1	+1.5
P1.1.7	2.45	60	40		0.035			0.05	+1.5
P1.1.8	2.45	60	40		0.04			0.1	+1.5
P1.1.9	2.45	60	40		0.035			0.085	+1.5
P1.1.10	2.45	60	40		0.025				+1.5
P1.1.11	2.45	60	40		0.035			0.07	+1.5
P1.1.12	2.45	40	60			0.02		0.05	+1.5
P1.1.13	2.45	DADMAC 40	HEA 60			0.03		0.1	+1.5
P1.1.14	2.45	DMAEMA*MeCl 60	40		0.035			0.2	+1.5
P1.2	2.45	60	40			0.1		0.2	+1.5
P1.2.1	2.45	60	40			0.075		0.2	+1.5
P1.2.2	2.45	60	40			0.075		0.2	+1.5
P1.2.3	2.45	60	40			0.04		0.1	+1.5
P1.2.4	2.45	60	40			0.049		0	+1
P1.2.5	2.45	60	40			0.045		0.05	+1.5
P1.2.6	2.45	60	40			0.04		0.025	+1.5
P1.2.7	2.45	60	40			0.045		0.0375	+1.5
P1.2.8	2.45	60	40			0.04		0.025	+1.5
P1.2.9	2.45	60	40			0.045		0.0375	+1.5
P1.2.10	2.45	60	40			0.04		0.025	+1.5
P1.2.11	2.45	60	40			0.04		0.025	+1.5
P1.2.12	2.45	60	40			0.04		0.025	+1.5
P1.2.13	2.45	60	40			0.04		0.025	+1.5
P1.2.14	2.45	60	40			0.04		0.0125	+1.5
P1.2.15	2.45	60	40			0.04		0.0125	+1.5
P1.2.16	2.45	60	40			0.04		0.0125	+1.5
P1.2.17	2.45	60	40			0.04		0.0125	+1.5
P1.2.18	2.45	60	40			0.04		0.0188	+1.5
P1.2.19	2.45	60	40			0.04		0.0125	+1.5
P1.2.20	2.45	60	40			0.04		0.0125	+1.5
P1.2.21	2.45	60	40			0.04		0.0125	+1.5
P1.2.22						0.04		0.0125	+1.5
P1.2.23	2.45	MAPTAC 70	AM 30			0.03		0.02	+1.5
P1.2.24	2.45	70	30			0.01		0.02	+1.5
P1.2.25	2.45	60	40	0.07				0.02	+1.5
P1.2.26	2.45	60	40			0.049			+1.5
P1.2.27	2.45	60	40			0.04		0.125	+1.5

P1.2.28	2.45	60	40			0.04		0.125	+1.0
P1.3.1	2.45	60	40				0.1	0.2	+1.5
P1.3.2	2.45	60	40				0.04	0.05	+1.5

DMA3*MeCl = Dimethylamino Ethyl Acrylate methochloride

DMAEMA*MeCl = DimethylAmino Ethyl MethAcrylate methochloride

AM = Acrylamide

HEA = Hydroxyethyl acrylate

MAPTAC = Trimethylaminopropyl ammonium acrylamide chloride

PETIA = pentaerythrityl triacrylate / pentaerythrityl tetraacrylate

TAAC = tetraallylammonium chloride

TMPTA = trimethylolpropane tris(polyethylene glycol ether) triacrylate

Examples with stabilizing agents A, C and D lead to comparable results as those obtained when using stabilizing agent B.

Table 2: Viscosities and viscosity slope of examples from table 1 and CE1 and 2

example	**Viscosity (mPa*s) of 1% product in deionized water measured at 30min (RT)**	**Viscosity (mPa*s) of aqueous solution containing 0,4% product and 100ppm calcium chloride solution measured at 2h (RT)**	**Viscosity (mPa*s) of formulation W3 containing 1wt% productmeasured at 2 h (RT)**	**Viscosity slope**
CE1	24 000	113	6300	5,9
CE2	14300	209	8300	5,1
Example 1	3300	140	2900	<4
Example 1.1	8050	109		7.2
Example 1.2	5900	179		5.3
Example 1.3	12640			
Example 1.4	12440		6300	
Example 1.5	4370	202	5700	5.0
Example 1.6	5830	168	6200	8.0
Example 1.7	8720	118	6400	5.0

Example 1.8	7460	111	6100	4.5
Example 1.9	6140	155	5700	3.4
Example 1.10	10440	89	6200	4.4
Example 1.11	8540	96	6500	5.0
Example 2	9280	214		5.2
Example 2.1	6200	260		3.6
Example 2.2	5630		6000	
Example 2.3	3100		5100	
Example 2.4	8820		6500	
Example 2.5	5800	312	6600	2.7
Example 2.6	5920	258	6400	3.3
Example 2.7	6770	252	6800	3.5
Example 2.8	6540	231	6100	2.2
Example 2.9	6870		6500	
Example 2.10	3940		5800	
Example 2.11	4940		5800	
Example 2.12	6240		5900	
Example 2.13	5060		5800	
Example 2.14	3380		5200	
Example 2.15	7890		6800	
Example 2.16	6780		7000	
Example 2.17	7010			
Example 2.18	6570			
Example 2.19	7080			

Example 2.20	6440			
Example 2.21	7790			
Example 2.22	5670			
Example 3	11460	90		9.1
Example 3.1	5040		6200	
Example 3.2	11220		6500	

Table 3: Storage Stability of the inverse dispersion

Example	**After 3 weeks at 25°C**	**After 4 months at 25°C**	**After 6 months at 25°C**
CE 1	Visible fine dispersed coagulum	serum, sediment, redispersable	serum, sediment, redispersable
CE2	Visible fine dispersed coagulum	serum, sediment, redispersable	serum, sediment, redispersable
Example 1	stable	stable	stable
Example 1.1	stable	stable	stable
Example 1.2	stable	stable	stable
Example 1.3	stable	stable	stable
Example 1.4	stable	stable	stable
Example 1.5	stable	stable	stable
Example 1.6	stable	stable	stable
Example 1.7	stable	stable	stable
Example 1.8	stable	stable	stable
Example 1.9	stable	stable	stable
Example 1.10	stable	stable	Light serum, light deposit, redispersable
Example 1.11	stable	stable	stable
Example 2	stable	stable	stable
Example 2.1	stable	stable	stable
Example 2.2	stable	stable	stable
Example 2.3	stable	stable	stable
Example 2.4	stable	stable	Light serum, light deposit, redispersable
Example 2.5	stable	stable	stable
Example 2.6	stable	stable	stable
Example 2.7	stable	stable	stable
Example 2.8	stable	stable	stable
Example 2.9	stable	stable	stable

Example 2.10	stable	stable	stable
Example 2.11	stable	stable	stable
Example 2.12	stable	stable	stable
Example 2.13	stable	stable	stable
Example 2.14	stable	stable	stable
Example 2.15	stable	stable	stable
Example 2.16	stable	stable	stable
Example 2.17	stable	stable	stable
Example 2.18	stable	stable	stable
Example 2.19	stable	stable	stable
Example 2.20	stable	stable	stable
Example 2.21	stable	stable	stable
Example 2.22	stable	stable	stable
Example 3	stable	stable	Light serum, light deposit, redispersable
Example 3.1	stable	stable	Light serum, light deposit, redispersable
Example 3.2	stable	Light serum, light deposit, redispersable	Light serum, light deposit, redispersable

If after storage time there is no solvent on top of the dispersion without polymer particles, called serum, and no polymer particles sedimented down after storage at room temperature and no co-agulum formed by aggregation of 2 or more particles the inverse polymer dispersion is called stable.

Table 4: Soluble non-cross-linked polymer fraction of examples from table 1 and comparative examples CE1 and 2:

Example	**Wt% for soluble part**
CE1	9
CE2	20
Example 1.1	25
Example 1.2	31
Example 1.4	16
Example 1.5	33
Example 1.6	27
Example 1.7	21
Example 1.8	23
Example 1.9	27
Example 1.10	25
Example 1.11	25

Example 2	22
Example 2.1	26
Example 2.3	42
Example 2.4	21
Example 2.5	27
Example 2.6	29
Example 2.7	28
Example 2.8	26
Example 2.9	24
Example 2.10	37
Example 2.11	30
Example 2.12	25
Example 2.13	31
Example 2.14	55
Example 2.15	24
Example 2.16	32
Example 2.17	29
Example 2.18	27
Example 2.19	34
Example 2.20	30
Example 2.21	23
Example 2.22	27
Example 3	19
Example 3.1	30
Exampl 3.2	19

Table 5 – finished product deposition performance in example Formula I (see Table 6) using dispersions from Table 1 and CE1 (P4) and CE2 (P2)

Dispersion in Formula I Chassis	Polymer Level (wt.%)	Initial Brookfield Viscosity (cPs)	Silicone (ug/g Fabric)
P2	0.2	105	122
P4	0.2	28	21
Example 1.5	0.2	112	280
Example 1.7	0.2	86	220
Example 1.8	0.2	79	223

Table 6: Example Formulas

The following are non-limiting examples of the fabric care compositions –

(%wt)	F1	F2	F3	F4	F5	F6
FSA [a]	11.2	7	9	-	-	-
FSA [b]	-	-	-	-	-	6
FSA [c]	-	-	-	14.5	13	-
Coco oil	0.6	0.5	0.45	-	-	-
Low MW Alcohol [d]	1.11	0.7	0.9	1.5	1.3	0.5
Perfume	1.75	0.6	2.1	1.5	2	1.2
Perfume encapsulate [e]	0.19	0.6	0.5	0.25	0.6	0.4
Calcium Chloride(ppm)	0.06	0.03	0.025	0.12	0.06	-
Chelant [f]	0.005	0.005	0.005	0.005	0.005	0.006
Preservative [g]	0.04	0.04	0.02	0.04	0.03	0.05
Acidulent (Formic Acid)	0.051	0.03	0.04	0.02	0.03	-
Antifoam [h]						0.05
Polymer [i]	0.17	0.15	0.2	0.12	0.16	0.35
Water soluble dialkyl quat [j]	0.25	0.2	0.1	0.5	-	0.25
Dispersant [k]	-	-	-	0.25	-	
Stabilizing Surfactant [l]	-	-	-	-	-	0.1
PDMS emulsion [m]	-	-	0.5		2	-
Amino-functional Organosiloxane Polymer	3	2		1	-	-
Dye (ppm)	0.03	0.03	0.02	0.04	0.04	0.02
Hydrochloric Acid	0.0075	0.0075	0.008	0.01	0.01	0.01
Deionized Water	Balance	Balance	Balance	Balance	Balance	Balance

[a] N,N-di(alkanoyloxyethyl)-N,N-dimethylammonium chloride where alkyl consists predominantly of C16 - C18 alkyl chains with an IV value of about 20 available from Evonik

[b] Methyl bis[ethyl (tallowate)] -2- hydroxyethyl ammonium methyl sulfate available from Stepan

[c] N,N-di(alkanoyloxyethyl)-N,N-dimethylammonium chloride where alkyl consists predominantly of C16 - C18 alkyl chains with an IV value of about 52 available from Evonik

[d] Low molecular weight alcohol such as ethanol or isopropanol

[e] Perfume microcapsules available ex Appleton Papers, Inc.

[f] Diethylenetriaminepentaacetic acid or hydroxyl ethylidene-1,1-diphosphonic acid

[g] 1,2-Benzisothiazolin-3-ONE (BIT) under the trade name Proxel available from Lonza

[h] Silicone antifoam agent available from Dow Corning® under the trade name DC2310

[i] Polymer 1 are chosen from Table 1

[j] Didecyl dimethyl ammonium chloride under the trade name Bardac® 2280 or Hydrogenated tallowalkyl(2-ethylhexyl)dimethyl ammonium methylsulfate from AkzoNobel under the trade name Arquad® HTL8-MS

[k] Non-ionic surfactant from BASF under the trade name Lutensol® XL-70

[l] Non-ionic surfactant, such as TWEEN 20™ or TAE80 (tallow ethoxylated alcohol, with average degree of ethoxylation of 80)

[m] Polydimethylsiloxane emulsion from Dow Corning under the trade name DC346®.

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm”.

All documents cited in the Detailed Description of the Invention are, in relevant part, incorporated herein by reference; the citation of any document is not to be construed as an admission that it is prior art with respect to the present invention. To the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the same term in a document incorporated by reference, the meaning or definition assigned to the term in this written document shall govern.

While particular aspects of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

CLAIMS

What is claimed is:

1. A composition comprising an inverse dispersion comprising
   a) a cationic polymer obtainable by the polymerization of
      (i) a cationic monomer and optionally a nonionic monomer (compound A),
      (ii) a trifunctional or polyfunctional monomer (compound B),
      (ii) optionally a chain transfer agent (compound C),
   b) a stabilizing agent, wherein the stabilizing agent has one or more hydrophobic chains with more than 30 carbon atoms,
   c) a non-aqueous carrier

   said composition being a fabric and home care product.

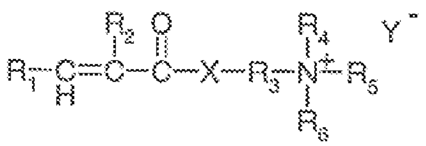
2. The composition according to claim 1, wherein the cationic polymer's amount of compound B lies in the range of from 50 ppm to 475 ppm based on the total amount of compounds A to C.

3. The composition according to claim 1 or 2, wherein the cationic polymer's compound B is a trifunctional monomer, a tetrafunctional monomer or a mixture thereof, preferably .said cationic polymer's compound B is pentaerythrityl triacrylate, pentaerythrityl tetraacrylate, tetrallylammonium chloride, 1,1,1-trimethylolpropane tri(meth)acrylate, the ethoxylated compounds thereof or a mixture thereof.

4. The composition according to any one of claims 1 to 3, the wherein the inverse dispersion's stabilizing agent has one or more hydrophobic chains with more than 50 carbon atoms.

5. The composition according to any one of claims 1 to 4, wherein the cationic polymer's compound A comprises at least one cationic monomer and at least one nonionic monomer and wherein the weight ratio of cationic monomer to nonionic monomer lies in the range of from 90/10 to 10/90.

6. The composition according to any one of claims 1 to 5, wherein the cationic polymer's cationic monomer is selected from a compound of the formula (I)



(I)

where

R_1 is H or $C_1 - C_4$ – alkyl,

R_2 is H or methyl,

R_3 is $C_1 - C_4$ – alkylene,

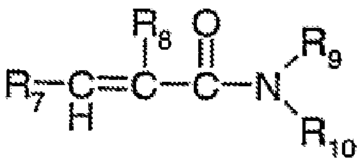
R_4, R_5 and R_6 are each independently H or $C_1 - C_{30}$ – alkyl, $C_1 - C_4$ alkyl alcohol, or C_4 alkoxy alcohol,

X is -O- or -NH- and

Y is Cl; Br; I; hydrogensulfate or methylsulfate

preferably said cationic polymer's cationic monomer is 2-(acryloyloxy)ethyl]trimethylammonium chloride.

7. The composition according to any one of claims 1 to 6, wherein the cationic polymer's nonionic monomer is selected from N-vinylpyrrolidone, N-vinylimidazole or a compound according to the formula (II)



(II)

where

R_7 is H or C_1–C_4-alkyl,

R_8 is H or methyl, and

R_9 and R_{10}, independently of one another, are H or C_1–C_{30}-alkyl,

preferably said cationic polymer's nonionic monomer is acrylamide.

8. The composition according to any one of claims 1 to 7, wherein the cationic polymer's compound C is selected from mercaptans, lactic acid, formic acid, isopropanol or hypophosphites.

9. The composition according to any one of claims 1 to 8, wherein the inverse dispersion's stabilizing agent has an ABA block-structure based on polyhydroxystearic acid as A block and polyalkylene oxide as B block.

10. The composition according to any one of claims 1 to 9, said composition comprises a fabric and home care ingredient selected from the group consisting of surfactants, builders, chelating agents, dye transfer inhibiting agents, dispersants, enzymes, enzyme stabilizers, catalytic materials, bleach activators, hydrogen peroxide, sources of hydrogen peroxide, preformed peracids, polymeric dispersing agents, clay soil removal/anti-redeposition agents, brighteners, suds suppressors, dyes, hueing dyes, perfumes, perfume delivery systems, structure elasticizing agents, fabric softeners, carriers, structurants, hydrotropes, processing aids, solvents and/or pigments and mixtures thereof, preferably said composition comprises a material selected from the group consisting of fabric softener active, perfume, perfume delivery system, hueing dye, suds suppressor and mixtures thereof, more preferably fabric softener, perfume, perfume delivery system, preferably perfume microcapsules, most preferably said composition comprises a fabric softener.

11. The composition according to any one of Claims 1 to 10, wherein said

a) fabric softener active is selected from the group consisting of a quaternary ammonium compound, a silicone polymer, a polysaccharide, a clay, an amine, a fatty ester, a dispersible polyolefin, a polymer latex and mixtures thereof, preferably said fabric softener active comprises a material selected from the group consisting of bis-(2-hydroxypropyl)-dimethylammonium methylsulfate fatty acid ester, 1,2-di(acyloxy)-3-trimethylammoniopropane chloride, N,N-bis(stearoyl-oxy-ethyl)-N,N-dimethyl ammonium chloride, N,N-bis(tallowoyl-oxy-ethyl) N,N-dimethyl ammonium chloride, N,N-bis(stearoyl-oxy-ethyl)-N-(2-hydroxyethyl)-N-methyl ammonium methylsulfate, N,N-bis-(stearoyl-2-hydroxypropyl)-N,N-dimethylammonium methylsulfate, N,N-bis-(tallowoyl-2-hydroxypropyl)-N,N-dimethylammonium methylsulfate, N,N-bis-(palmitoyl-2-hydroxypropyl)-N,N-dimethylammonium methylsulfate, N,N-bis-(stearoyl-2-hydroxypropyl)-N,N-dimethylammonium chloride, 1,2-di-(stearoyl-oxy)-3-trimethyl ammoniumpropane chloride, dicanoladimethylammonium chloride, di(hard)tallowdimethylammonium chloride, dicanoladimethylammonium methylsulfate, 1-methyl-1-stearoylamidoethyl-2-stearoylimidazolinium methylsulfate, 1-tallowylamidoethyl-2-tallowylimidazoline, dipalmylmethyl hydroxyethylammoinum methylsulfate and mixtures thereof; and

b) said microcapsules comprises a shell that comprises melamine formaldehyde and/or polyacrylate, preferably said perfume microcapsules comprises a deposition coating, preferably said coating comprises a cationic polymer, preferably said cationic polymer comprise hydrolyzed and/or partially hydrolyzed p polyvinyl formamide.

12. The composition according to any preceding claim, said composition comprising a fabric softening active having an Iodine Value of between 0-140, preferably 5-100, more preferably 10-80, even more preferably 15-70, even more preferably 18-60, most preferably 18-25 or when said fabric softening active comprises a partially hydrogenated fatty acid quaternary ammonium compound said fabric softening active most preferably has a Iodine Value of 25-60.

13. A process for the manufacture of a composition, said process comprising combining an inverse dispersion comprising

a) a cationic polymer obtainable by the polymerization of
   (i) a cationic monomer and optionally a nonionic monomer (compound A),
   (ii) a trifunctional or polyfunctional monomer (compound B),
   (iii) optionally a chain transfer agent (compound C),
b) optionally a stabilizing agent, wherein the stabilizing agent has one or more hydrophobic chains with more than 30 carbon atoms,
c) a non-aqueous carrier,

wherein the inverse dispersion is obtained by inverse emulsion polymerization, optionally followed by distillation by means of the liquid dispersion polymer technology,
and a fabric and/or home care ingredient.

14. Use of the inverse dispersion recited in any one of Claims 1 to 12 as a thickener in fabric and home care products.

15. A method of treating comprising:

i) optionally, washing rinsing and/or drying a fabric and/or surface
ii) treating said fabric and/or surface with a composition according to any of Claims 1-12
iii) optionally, washing rinsing and/or drying a fabric and/or surface.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/041737

A. CLASSIFICATION OF SUBJECT MATTER
INV. C11D3/00 C11D3/37
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
16 October 2015	23/10/2015

Name and mailing address of the ISA/	Authorized officer
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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International application No
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