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(54) Fabric softener compostitions.

(57) Stable aqueous fabric softening compositions based on water-dispersible cationic fabric softeners such as the di-long chain, di-short chain quaternary ammonium salts are provided using a combination of fatty alcohol and cationic water-soluble polymer to improve the rheological properties to enhance the softening performance. Both concentrated and ready-for-use formulations can be prepared. The active ingredients concentration in the concentrated formula is generally in the range of 11 to 20% by weight while for the ready-for-use formulations, concentration of the active ingredients may range from about 3 to about 8% by weight. In either case, the weight ratio of cationic softening agent to fatty alcohol may range from about 100:1 to about 1:1 and the ratio of cationic softener to cationic water-soluble polymer may range from about 100:1 to 1:1. These compositions have medium viscosity and are easily dispersible. Method for making the compositions are also disclosed.

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FABRIC SOFTENER COMPOSITIONS

Background of the Invention

The present invention relates to fabric softener compositions, especially adapted for use in the rinse cycle of a laundering process and, in particular, to both the concentrated and ready-for-use aqueous fabric softener compositions which are stable at both low and high ambient temperature, i.e. the compositions do not form a gel, and which are easily dispersible in water when used.

Compositions containing quaternary ammonium salts having at least one long chain hydrocarbyl group are commonly used to provide fabric softening benefits when employed in a laundry rinse operation; for example, see U.S. Patents 3,349,033; 3,644,203; 3,946,115; 3,997,453; 4,073,735; 4,119,545; etc.

For most aqueous softener compositions containing cationic quaternary ammonium compounds or imidazolinium compounds as active ingredients, concentrations of such cationics has, in general, been limited to the range of about 3 to 6 or 7% by weight (see, e.g., U.S. Patent 3,904,533 and U.S. Patent 3,920,565). Such a low concentration is generally necessitated by the fact that cationics form gels in water systems at concentrations at above about 8%. While the use of electrolytes to lower the viscosity of such compositions is known (see, e.g. U.S.' Patent 4,199,545), such electrolytes are far from satisfactory. From a functional point of view, eht electrolytes often do not perform as required, particularly at concentration of the cationics in the neighborhood of about 12-15%. Further, while the performance of the electrolytes may mitigate some of the gelling problem, their use is far from satisfactory in providing a highly concentrated aqueous system of cationics which does not gel or severly change in viscosity within the usual range of temperatures encountered in the handling thereof, for example 0° F(about - 18° C) up to about 140° F (about 60° C).

In U.S. Patent 3,974,076, there is disclosed quaternary ammonium-containing softening composition of conventional cationic concentrations, i.e. about 3% to about 8%. These compositions are characterized by the very small particle size of the substantially water-insoluble quaternary ammonium softening compound, i.e. 90% by weight of the quaternary ammonium compound exists as particles which pass through a 1.2 micron filter. The components of the composition are present in the proportions of from about 2 parts to about 10 parts (preferably from about 3 to about 8 parts) by weight of the water dispersible quaternary ammonium compound; from about 0.1 to 2 parts by weight of the C_8 to C_{20} fatty alcohol, with the weight ratio of quaternary compound to alcohol being in the range of from about 100:1 to about 5:1; from about 0.1% to about 2.0% by weight of a nonionic surfactant, the balance being a water-soluble liquid carrier.

In fact, the use of fatty alcohols as softening ingredients or as viscosity regulating agents in fabric softening compositions has been described elsewhere in the patent literature. For example, U.S. Patent 4,213,867 to Cukier and Khan describes fabric conditioning compositions containing quaternary ammonium compounds and fatty alcohols or phosphoric acid esters thereof in admixture with a diluent; the compositions are pumpable at room temperature and are easily dispersed in water. These compositions are highly concentrated base mixes for subsequent dilution prior to distribution and use. The compositions generally contain between about 50 to 80% of quaternary ammonium compound, diluent (C_1 to C_4 alkanol plus water) constituting between about 15 to 35% of the base mix and a third component in an amount of from about 5 to 25% which is a C_{18} to C_{28} fatty alcohol or a phosphoric acid ester thereof or mixtures thereof. The base mix is diluted with water to form an aqueous emulsion of 2-10% concentration based on the combined active ingredients, i.e. quaternary ammonium compound and fatty alcohol or phosphate ester.

U.S. Patent 4,386,000 to Turner, et al. describes a concentrated fabric softening composition containing a cationic softener and a viscosity control agent which is a combination of a first component, which is a noncyclic hydrocarbon, fatty acid, fatty acid ester, or fatty alcohol, with a water-soluble cationic polymer having an average molecular weight in the range of from about 2,000 to about 250,000. The water-insoluble cationic fabric softener is present in the composition in an amount of from 8% to 22% and the viscosity regulator system includes from 0.5 to 6% of the first regulator component and from about 0.05 to about 1% of the water-soluble cationic polymer as the second regulator component.

The Turner, et al. patent is stated to be an improvement over the Verbruggen European Patent Application 79200801.3 corresponding to Verbruggen U.S. Patent 4,426,299. The Verbruggen patent discloses concentrated fabric softening compositions comprising water-insoluble cationic fabric softener and a viscosity control agent which may be a noncyclic hydrocarbon, a fatty acid, or ester thereof, or a fatty alcohol at a ratio of fabric softener to viscosity control agent of from 5:1 to 20:1. According to Turner, et al. these compositions are less effective as viscosity reducing agents and concentrated compositions at temperatures close to or above the Krafft point of the cationic softener.

European Patent Application 0086105 describes fabric softening compositions containing a cationic softener, lanolin and a viscosity control agent which may be an electrolyte, a polymer such a polyethylene glycol, a C_{12} - C_{40} hydrocarbon and halogen derivatives thereof, C_9 - C_{24} fatty acids, fatty acid esters thereof, C_{10} - C_{18} fatty alcohols or water miscible solvents. The cationic softener's present in amounts of 0.5 to 30% by weight, the lanolin in amounts of from 0.25 to 40% by weight and, when the viscosity control agent is the fatty alcohol, it is present in amounts of 0.25 to 15% by weight. The aqueous medium comprises at least 25% of the composition and preferably at least 40% of the composition. However, none of the actual examples shown in this patent include fatty alcohol viscosity adjusting agent.

United Kingdom Patent Application GB 2,007,734A describes a fabric softener concentrate for subsequent dilution to the final concentration of active ingredients. The concentrate contains a fatty quaternary ammonium salt which contains at least one long chain alkyl group of 8 to 30 carbon atoms, and an oil or substantially water-insoluble compound having oily/fatty properties. The latter includes, among others, long chain fatty alcohols. Proportions of quaternary fabric softener to fatty alcohol compound of 1:9, 1:5, 4:6, 9:10 or 9:1 by weight are shown, generally with a lower alkanol alone or with an additional nonionic surfactant to provide liquid concentrate or diluted composition. The fabric softening compositions, i.e. the concentrates diluted with water, are described as including from 3 to 20% by weight of active ingredients. However, the actual examples only show amounts of active ingredients ranging from about 2.33 to 10% by weight.

French Patent 2,298,600 and corresponding German Patent 2,503,026 to Hoechst A.G. describe liquid aqueous preparations for landry sof tening-rinsing agents, which include a germicidal agent. These preparations include a mixture of a quaternary ammonium salt cationic fabric softener and an alkyl imidazolinium compound fabric softener compound at a weight ratio of 2:1 to 1:2; about 1 to 6% by weight of a cationic disinfecting agent; about 0.5 to 5% by weight of a long chain fatty alcohol; about 0.1 to 5% by weight of a lower alkanol having about 1 to 3 carbon atoms; 0 to about 5% by weight of a nonionic emulsifier and the balance water, perfume, coloring matter and optical brighteners.

German De 3,150,179-A1 to Hoechst A.G. relates to concentrated liquid premixtures of cationic fabric softeners with alkoxylated amines and an additional ingredient which may be a fatty alcohol. Example 3 of this patent shows a concentrate containing 40% of the cationic fabric softener, 45% oleyl alcohol and 15% alkoxylated amine. Example 5 shows a concentrate including 70% by weight of the cationic quaternary ammonium salt fabric softener, 20% isostearly alcohol and 10% alkoxylated amine.

U.S. Patent 3,644,203 to Lamberti, et al. discloses a fabric softening composition which is a mixture of a (a) cationic fabric softener and (b) a complex of (i) C_{12} to C_{22} fatty alkanol or alkane diol and (ii) alkali metal alkyl (C_{12} to C_{18}) sulfate at a ratio of (a):(b) between 1.4:1 and 10:1 and a molar ratio (i):(ii) between 1:1 and 1:2.

In British Patent 1,604,030 and substantial equivalent disclosures in U.S. Patents 4,179,382 and 4,237,016 and European Patent Specification 0002085 published March 2, 1983, there is a disclosure of cationic copolymers interalia, of dialkylaminoalkyl methacrylate with styrene, neutral acrylic ester and N-vinyl pyrrolidone as scavangers for anionic-surfactant carry over when used with cationic softeners in the rinse cycle. The softening properties of the general class of polymeric cationic salts is also suggested.

While satisfacotry results may be obtained with one or more of these prior art fabric softener compositions still further improvements are desired in terms of softening performance, ease of handling, storage stability, dispersibility in cold water, viscosity control and overall cost s effectiveness.

Summary of the Invention

The present invention provides low and high temperature stable, aqueous softener composition based upon cationic fabric softening compounds and a fatty alcohol having an alkyl group of from about 10 to about 22 carbon atoms, and a water-soluble cationic polymer.

More particularly, the present invention provides stable, aqueous, cold and warm water dispersible fabric softener compositions which comprise

(A) 3 to 35% by combined weight of (i) a cationic fabric softener and (ii) a fatty alcohol having an alkyl group with from about 10 to about 22 carbon atoms and (iii) a water-soluble cationic polymer at a weight ratio of (i):(ii) of from about 100:1 to 1:1 and of (i):(iii) of about 100:1 to 1:1;

(B) 0 to 0.5% by weight of a water soluble electrolyte;

(C) 0 to 5% by weight of an emulsifier; and

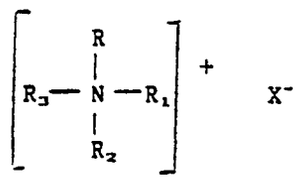
(D) balance to 100% of water and optionally, one or more of perfume, colorant, optical brightener, and disinfectant.

Detailed Description of Preferred Embodiments

The compositions of the present invention are stable aqueous compositions which contain mixtures of a cationic fabric softeners which is preferably a water-dispersible quaternary ammonium compound salt or a water dispersible alkyl imidazolinium compound salt or a water dispersible alkyl imidazolinium compound salt as hereinafter described in more detail, a fatty alcohol, and a cationic water-soluble polymer, also as hereinafter described.

Softening agents are used to render fabrics or textile soft, and the terms "softening" and "softener" refer to the handle, hand, touch, or feel; this is the tactile impression given by fabrics or textiles to the hand or body and is of aesthetic and commercial importance. The cationic fabric softeners used in the present invention may be any of the commericially available and known cationic fabric softeners and preferably are of the water-insoluble albeit water-dispersible quaternary ammonium compound salt or alkyl imidazolinium compound salt type including at least one, and preferably two hydrophobic groups containing at least 12 and preferably at least 14 carbon atoms.

One preferred class of the cationic softeners are the quaternary ammonium salts of the formula I:



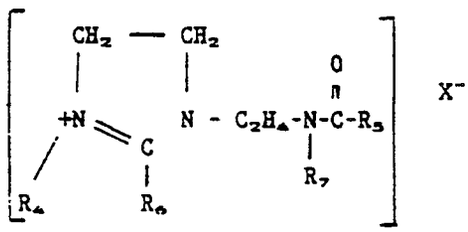
wherein R represents a hydrocarbyl group of from about 12 to 24 and preferably about 14 to 22 carbon atoms; R_1 represents lower alkyl of 1 to 4, preferably 1 to 3, carbon atoms, or a hydrocarbyl group of from 12 to 24, preferably 14 to 22, carbons atoms; R_2 and R_3 represent lower alkyl of 1 to 4, preferably 1 to 3, carbon atoms, and X represents an anion cable of imparting water solubility or dispersibility, such as halide, e.g. chloride, bromide and iodide; sulfate, methosulfate, nitrite, nitrate, phosphate, and carboxylate, e.g. acetate, adipate, propionate, phthalate, benzoate, oleate, etc.

The hydrocarbyl groups are preferably alkyl but may be alkeny, aryl, or aralkyl and may include various substituents or interrupting groups such as halo, amide, hydroxyl, and carboxyl substituents or interrupting functional groups and ethoxy or polyethoxy interrupting groups. In addition, one or more of the lower alkyl groups may also be substituted for example, by an hydroxy group. Typical cationic fabric softener compounds of formula I include the following:

distearyl dimethyl ammonium chloride
ditallow dimethyl ammonium chloride
dihexadecyl dimethyl ammonium chloride
distearyl dimethyl ammonium bromide
di(hydrogenated tallow) dimethyl ammonium bromide
distearyl di(isopropyl) ammonium chloride
distearyl dimethyl ammonium methosulfate

A highly preferred class of the cationic fabric softeners of formula I are the water-insoluble compounds wherein the groups R and R_1 are C_{14} to C_{18}, R_2 is methyl or ethyl and R_3 is methyl, ethyl, isopropyl, n-propyl, hydroxyethyl or hydroxypropyl.

A second preferred class of the cationic fabric softener active ingredient are the imidazolinium compounds of the formula II:



wherein R_4 is hydrogen or lower alkyl of 1 to 4 and perferably 1 to 3 and especially preferably 1 or 2 carbon atoms, R_5 is an alkyl containing from 9 to 25 carbon atoms, preferably linear higher alkyl of from

about 13 to 23 and especially preferably 13 to 19 carbon atoms, R_6 is an alkyl containing from 8 to 25 carbons and preferably a substantially linear higher alkyl group of about 13 to 23, and preferably 13 to 19 carbon atoms; R_7 is hydrogen or an alkyl containing from 1 to 4 carbon atoms, preferably 1 or 2 carbon atoms, and X is as defined above.

Typical examples of the alkyl imidazolinium compounds of formula II include:
methyl-1-tallow amido-ethyl-2-tallow imidazolinium methyl sulfate,
methyl-1-oleyl amido-ethyl-2-oleyl imidazolinium methyl sulfate,
1-methyl-1-(palmitoylamido)-ethyl-2-octadecyl-4,5-dihydroimidazolinium chloride,
2-hepadecyl-1-methyl-1-(2-stearylamido)-ethylimidazolinium chloride,
2-lauryl-1-hydroxyethyl-1-oleyl-imidazonlinium chloride.

The water dispersible cationic fabric softeners which can be used in the compositions of the present invention are not limited to those described above and any of the other known useful water dispersible cationic fabric softeners can be used. Furthermore, mixtures of the above mentioned cationic fabric softeners can also be used. The amount of softener may range from about 2 to about 35% and generally up to 6, 8 or 10% for the so-called 1:1 use formulation and from about 10, 12 or 15% up to 20, 25, 30 and 35% for the so-called "3:1 concentrates".

The second ingredient of the compositions is the fatty alsohol wherein the hydrophobic group may be a straight or branched chain alkyl or alkenyl group having from about 10 to 24, preferably from about 10 to 20, especially preferably from about 12 to 20 carbon atoms. Specific examples of the fatty alcohol include decanol, dodecanol, tetradecanol, pentadecanol, hexadecanol, octadecanol, lauryl alcohol, palmityl alcohol, stearyl alcohol, oleyl alcohol, and mixtures thereof. Furthermore, the fatty alcohol may be of natural or synthetic origin and may include, for example, mixed alcohol, such as C_{16} to C_{18} alcohols prepared by Ziegler polymerization of ethylene.

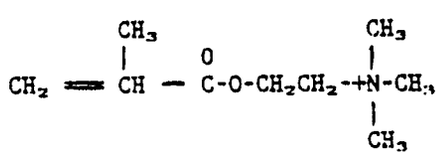
The fatty alcohol is present in the composition in a lesser amount relative to the cationic fabric softener such that the ratio, by weight, of the cationic fabric softener to fatty alcohol is in the range of from about 100:1 to about 1:1, preferably from about 10:1 to about 3:1, especially preferably about 6:1 to 3:1. Within these proportions, the fatty alcohol may be present in the formulation, based on the total weight of the aqueous composition, in the range of from about 1 to 10% by weight, preferably about 2.0 to 5% by weight, for the concentrated formulation, and in the range of from about 0.2 to 2%, preferably from about 0.1 to 1.5% by weight for the ready-to-use formulation.

The amount of the water-soluble cationic polymer relative to the cationic softener, on a weight basis, is such that the ratio of softener to polymer ranges from about 100:1 to 1:1, preferably 50:1 to 2:1, more preferably 30:1 to 5:1.

The cationic polymers are generally the polymerized and quaternized amine derivatives of acrylic acid, methyacrylic acid, and methacrylamide. The homopolymers are preferred but copolymers with less than about 50 mole % of polymerizable comonomers (B) may be used. Illustrative monomers (before quaternization) are
N,N-dimethyl amino acrylate
N,N-diethyl amino acrylate
N,N-dimethyl amino methacrylate
N,N-diethyl amino methacrylate
N,N-di-isopropyl amino methacrylate
and copolymers with
e.g. N-vinyl pyrrolidone
vinyl methyl ether

Suitable molecular weights range from about 50,000 to several million (e.g. 100,000; 250,000; 400,000; 1 million, 2 million etc.).

The most preferred material is a homopolymer of the monomer unit of the formula



The total amount of the active fabric softening components (cationic fabric softener plus fatty alcohol) should be at least about 11% by weight, preferably at least 12% by weight, more preferably about 12 to

20% by weight, especially preferably 12 to 16% by weight, for the concentrated formulation. Within these high concentrations of the fabric softening components, highly stable and pourable compositions can be obtained which do not gel upon addition to cold or warm water. Furthermore, in view of the high total amounts of the active fabric softening components, the consumer is provided with a wide choice in suitable dosages which can still provide effective softening over wide ranges of fabric loads. Generally, however, it is sufficient to provide the compositions of this invention in amounts which provide a concentration in the range of from about 10 ppm to 10,000 ppm, preferably from about 50 ppm to about 500 ppm, of total active ingredients when added to the rinse liquor of a washing cycle. Accordingly, the formulations should be diluted prior to use in an amount depending on the staring concentration and desired leval of performance, from about 1 to 4 times, preferably 2 to 3 times with water. Tap water is sufficient for this purpose. For the ready-to-use formula, which can be added directly to the fabrics, generally during the rinse cycle of the overall washing operation in an automatic washing machine, the total amount of active softening ingredients will be from about 3 to 8%, preferably from about 3.5 to 6% by weight, based on the total composition.

It is one of the outstanding advantages of the present invention that it is not required to include any additional ingredients such as nonionic surfactant emulsifiers, lower alkanols, etc. to formulate stable homogeneous pourable compositions from the mixed cationic fabric softener and fatty alcohol. However, compositions of just cationic softener and fatty alcohol tend to be of too low a viscosity and the addition of the polymer not only overcomes this dificiency but also does not detract from softening performance.

The use of nonionic surfactant dispersants may be resorted to and in this regard references is made to U.S. Patent 3,974,076, Col. 5 line 14 to Col. 7 line 13 and the nonionics and their amounts mentioned are incorporated herein by reference. Also, useful are the ethoxylated amines and their salts described in U.S. Patent 4,772,403.

In addition to the foregoing components of the softening compositions of this invention, there may also be included numerous conventional, supplemental and optional ingredients which do not adversely affect the stability and/or functional characteristics of the instant compositions. Thus, for example, there may be present the ubiquitous perfumes, dyes, pigments, opacifiers, germicides, optical brighteners, anti-corrosion agents, preservatives, and the like. Where used, each of these components may comprise up to about 0.5%, preferably up to about 0.2%, for example from 0.001% to about 0.1% by weight of the aqueous composition. The use of perfumes, dyes and optical brighteners are especially preferred additives in terms of consumer appeal.

The balance of the compositions of the present invention is provided by water which may be distilled, deionized or tap water.

As noted above, it is generally not required to add any additional ingredients to the active fabric softening components in order to provide the homogeneous stable low viscosity pourable and dispersible fabric softening compositions of this invention.

For example, in the case of one preferred embodiment of the invention wherein the cationic fabric softener is distearyl dimethyl ammonium chloride (DSDMAC) and wherein the fatty alcohol is a C_{16} to C_{18} alkyl alcohol, the composition is prepared directly using a high pressure homogenizer. Thus, a mixture of DSDMAC and the C_{16} - C_{18} alcohol when dispersed in hot water forms a gel which can be broken in high pressure homogenizer resulting, after cooling, in a stable liquid product.

The following examples will serve to illustrate the present invention without being deemed limitative thereof. Parts are by weight unless otherwise indicated.

EXAMPLE I

A composition is prepared containing

	Weight %
Di-hydrogenated tallow dimethyl ammonium chloride	3.6
C_{16} - C_{18} alcohol	0.9
Hompolymeric N,N-dimethyl ammonium ethyl methacrylate chloride	0.2

This composition gives better softeness than one without the polymer. Futhermore, the viscosity without the polymer is very low (20 - 40 cps) whereas with it, the viscosity ranges from 100 to 400 cps.

Claims

1. A stable, medium viscosity aqueous fabric softening composition comprising a water-insoluble cationic softener, fatty alcohol and a water-soluble cationic polymer.

2. A composition according to claim 1 wherein the weight ratio of cationic softener to fatty alcohol ranges from about 100:1 to 1:1 and the weight ratio of cationic softener to cationic polymer ranges from about 100:1 to 1:1.

3. A composition according to claim 2 wherein the amount of cationic softener, cationic polymer and fatty alcohol ranges from about 3% to about 50%.

4. A composition according to claim 3 containing 3 to 5% quaternary ammonium softener 0.75 to 1.5% fatty alcohol and 0.1 to .5% water-soluble cationic acrylic polymer.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 40 1065

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X,Y D	EP-A-0043622 (THE PROCTER & GAMBLE COMPANY) * the whole document * & US-A-438600	1-4	C11D3/37 C11D3/20
Y	EP-A-0299787 (KAO CORPORATION) * the whole document *	1-4	
A,D	GB-A-2207446 (COLGATE PALMOLIVE COMPANY) * page 20, line 1 - page 25, line 21 *	1-4	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

C11D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 JULY 1990	TETAZ F.C.E.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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