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3,095,373

FABRIC SOFTENERS

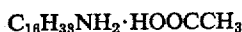
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No Drawing. Filed Jan. 30, 1959, Ser. No. 790,055
11 Claims. (Cl. 252-8.8)

This invention relates to fabric softening compositions and, more particularly, to cationic fabric softeners formulated to impart uniform softness to fabrics treated therewith.

Cationic finishing agents, sometimes referred to as cation-active softeners, are those materials which dissolve or disperse in water, concentrate and orient at interfaces, and ionize in such a way that the cation includes a hydrocarbon chain, generally containing from 8-25 carbon atoms. These finishing agents are widely used for imparting pliability and drape, particularly to cellulosic fibers, and as after treatment to improve water-fastness of substantive dyestuffs. Cationic fabric softeners are characterized by their substantive properties, and by the efficiency of their softening and lubricating action upon fabrics treated with the same. Cationic finishing agents are employed in conjunction with thermosetting resins, sizing or stiffening agents, pigment-type dullers, flame retardants and in the production of bacteriostatic or mildew-resistant fabrics and, in addition, find application as anti-static lubricants.

Cationic chemical compounds of the type employed for finishing textiles are organic salts characterized by a cation containing a hydrophobic chain having at least about 16 carbon atoms. Typical cationic compounds which can be used as finishing agents for textiles are listed below.

Salts of simple primary amines:



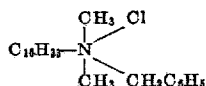
(Hexadecyl amine hydroacetate)

Salts of simple tertiary amines:



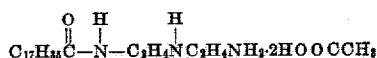
(Hexadecyl dimethyl amine hydroacetate)

Quaternary ammonium salts:



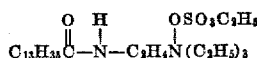
(Hexadecyl dimethyl benzyl ammonium chloride)

Salts of amino amides:



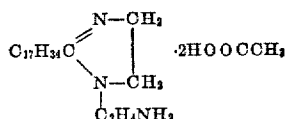
(Monostearoyl diethylene triamine dihydroacetate)

Quaternary ammonium salts of amino amides:



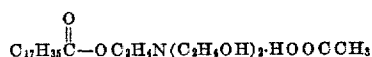
(β -Diethyl aminoethylstearamide ethosulfate)

Salts of imidazolines:



(α -Heptadecyl, N-aminoethyl imidazoline dihydroacetate)

Salts of amino esters:



(β -Dihydroxyethyl amine stearatehydroacetate)

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An excellent review of the history and development of cationic finishing agents as well as the chemical and physical properties and method of preparation of some of the more commercially important cationics is presented by Speel and Schwarz, Textile Chemicals and Auxiliaries, second edition, Reinhold Publishing Corporation, 1957, in chapter 18. Other publications pertinent to the use of cationics as fabric softening agents include an article entitled "Cationic Fabric Softeners," by P. L. Du Brow et al., Soap & Chemical Specialties, 33 (4), 89, 1957, and an article entitled "Fabric Treatment with Cationic Softeners," by W. M. Linfield et al., The Journal of the American Oil Chemists Society, 35 (11), 590 (1958).

Although the cationic fabric softeners have found their largest application in the cellulosic finishing market where they are employed to give an initial softening effect and to reduce fabric harshness and scratchiness, they are also finding significant application in the commercial and home laundry operations where they are used in the after rinse to impart softness to the laundered fabrics and/or to impart anti-static properties to synthetic fabrics manufactured from rayon, nylon, polyester and polyacrylic fibers. A method for employing cation-active textile softening agents for imparting softness to laundered textiles is disclosed in U.S. Patent No. 2,734,830, W. Hagge et al. (1956). Hagge et al. disclose a process for washing and softening textile goods that are already soft to the touch and are usually repeatedly laundered, which comprises washing the textile goods with a conventional synthetic detergent containing an anionic surfactant in combination with one or more alkaline builders and rinsing the goods in a separate bath containing a cation-active textile softening agent. The cation-active softeners which can be employed in accordance with the method disclosed by Hagge et al. include, for example, the quaternary ammonium compounds and higher molecular weight imidazolines. I have found, however, that these particular softening agents when used either in the rinse cycle of an ordinary laundry operation or in a separate bath following the rinse cycle are not uniformly distributed upon the surface of the fabrics treated therewith and, consequently, do not, therefore, impart uniform softness to said fabrics. In addition, I have found that accidental spillage of this type of fabric softener upon any portion of the fabric extending above the surface of the rinse bath results in the fabric containing an area, corresponding to the area of spillage, of highly concentrated fabric softener. Such area, or areas, tends to be highly hydrophobic. Since the fabric softener concentrates at the area of spillage and is not redistributed upon the fabric after the fabric is completely immersed in the rinse bath, the whole fabric is, therefore, not uniform with respect to softness.

An object of this invention is, therefore, to provide a fabric softening composition which imparts uniform softness to fabrics treated therewith.

Another object of this invention is to provide a fabric softening composition which, when accidentally spilled upon a portion of the fabric extending above the surface of the rinse water, does not impart to the area of spillage a high concentration of fabric softener.

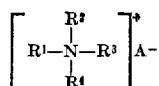
A further object of this invention is to provide a fabric softener composition in the form of a free-flowing powder which can be easily employed during the rinse cycle of a home or commercial laundry operation and which imparts uniform softness to fabrics treated therewith.

A still further object of this invention is to provide a method for treating fabrics so as to impart uniform softness to said fabrics.

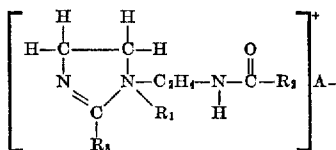
These and other objects will become apparent as this specification proceeds.

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In accordance with this invention, a fabric softening composition which imparts uniform softness to fabrics treated therewith is provided, which comprises about (I) 1-70 percent by weight of a fabric softening agent selected from the group consisting of (1) quaternary ammonium compounds conforming to the following formula:



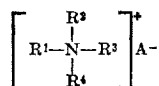
wherein R^1 and R^2 are lower alkyl radicals, R^3 is a fatty alkyl radical, R^4 is a member selected from the group consisting of fatty alkyl radicals and aralkyl radicals and A is an anion and (2) imidazolinium compounds conforming to the following formula:



wherein R_1 is a lower alkyl radical, R_2 is a member selected from the group consisting of lower alkyl and hydrogen radicals and R_3 is a fatty alkyl radical and A is an anion, and (II) at least about 30% by weight of a finely divided, highly porous absorbent.

The fabric softening compositions of the invention, when employed in the rinse cycle of a conventional laundry operation or when used in a separate rinse bath, are particularly advantageous because they impart uniform softness to fabrics treated therewith. In addition, as will be more readily apparent from certain of the examples hereinafter set forth, accidental spillage of the compositions of the invention upon a portion of the fabric extending above the surface of the rinse bath does not result in an area or areas of high fabric softening agent concentration after the rinse step. These advantageous features possessed by the compositions of the invention constitute a significant advance in the fabric softening art and overcome the disadvantages inherent in the fabric softening compositions of the prior art such as nonuniform distribution of the softening agent and areas of high fabric softening agent concentration due to accidental spillage.

The quaternary ammonium compounds which can be used in the compositions and method of the invention conform to the following formula:



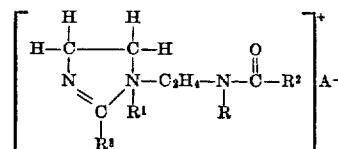
wherein R^1 and R^2 are lower alkyl radicals containing from about 1-4 carbon atoms each, and preferably from about 1-2 carbon atoms, R^3 is a fatty alkyl radical containing from about 8-25 carbon atoms and preferably at least about 16 carbon atoms, and R^4 is a member selected from the group consisting of fatty alkyl radicals having the same characteristics as R^3 and aralkyl radicals such as the benzyl radical. A is an anion which may be acetate, chloride, bromide, methylsulfate, lactate and the like. The preferred anions include methylsulfate, chloride and bromide.

Examples of quaternary ammonium compounds which can be employed in the compositions and method of the invention include cetyl dimethyl benzyl ammonium chloride, dimethyl distearyl ammonium chloride, dimethyl dieicosyl ammonium chloride, diethyl distearyl ammonium chloride, diethyl oetyl stearyl ammonium chloride, and methyl ethyl lauryl cetyl ammonium chloride.

The imidazolinium compounds which can be used in

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the compositions and method of the invention conform to the following formula:



wherein R^1 is a lower alkyl radical containing from about 1-4 carbon atoms and preferably from about 1-2 carbon atoms, R^2 is either a lower alkyl radical containing from about 1-4 carbon atoms or a hydrogen radical and R^3 is a fatty alkyl radical containing from about 8-25 carbon atoms and preferably at least about 15 carbon atoms. A is an anion which may be a halide such as chloride or bromide or a sulfate such as methyl sulfate, or the anion of an organic acid such as lactate or acetate. The imidazolinium compound useful in the invention can be prepared by condensing a fatty acid with triethylene-diamine so that two molecules of water are removed, thereby forming an imidazoline compound. This imidazoline compound is then neutralized with a suitable short chain organic acid such as formic acid, acetic acid and the like or an acid anhydride such as acetic anhydride. The neutralized imidazoline is then quaternized with a suitable anion contributing material such as methyl chloride or dimethylsulfate. The fatty alkyl radical of the imidazolinium compounds of the invention is derived from the fatty acid reactant. Examples of fatty acids which can be employed to prepare the imidazolinium compound include arachidic acid, stearic acid, palmitic acid, myristic acid, lauric acid, capric acid, and caprylic acid.

The long chain hydrocarbon radicals in the quaternary and imidazolinium fabric softening agents are usually those as are contained in animal and vegetable fats and may be in the pure form or as mixtures containing saturated and unsaturated groups.

The quaternary ammonium compound, dimethyl distearyl ammonium chloride, employed in certain of the examples and claims hereinafter set forth contains two long chain hydrocarbon radicals. These radicals are actually a mixture of fatty alkyl radicals and an average composition will contain about 75 weight percent of the octadecyl radical, 24 weight percent of the hexadecyl radical and 1 weight percent of the octadecenyl radical.

The absorbent materials which can be blended with the aforementioned quaternary and imidazolinium compounds in order to prepare the fabric softening compositions of the invention are finely divided, highly porous siliceous compositions which have a pH from about mildly alkaline to slightly acid. Examples of finely divided, highly porous siliceous compositions include silica gel, diatomaceous earth, fuller's earth, bentonite, finely divided silica, synthetic calcium silicate and mixtures thereof. Although naturally occurring siliceous compositions give good results when employed in the fabric softening compositions of the invention, synthetic silicates are preferred because of the economical advantages which accrue due to their use, since smaller amounts of the synthetic silicates can be used to produce comparable results.

Bentonite is essentially sodium aluminum silicate having the following formula: $[Na_{0.33}Al_{1.67}Si_4O_{10}(OH)_2]$. This material is preferably ground into a finely divided state such that almost all of a representative sample thereof will pass through a 100 mesh screen and not more than about 12% by volume will be retained on a 200 mesh screen. Fuller's earth is essentially magnesium aluminum silicate and the preferred form of this clay has a particle size corresponding to that of bentonite. A complete description of these siliceous compositions including location of deposits, method of processing and chemical analysis is presented in volume 4 of the Encyclopedia of Chemical Technology at pages 28 to 30 and 49 to 53.

Silica gel is a partially dehydrated form of polymerized

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colloidal silica and is more fully described in volume 12 of the Encyclopedia of Chemical Technology at pages 345 to 360. In the preferred embodiment, this siliceous composition has an apparent bulk density (specific gravity) from about 0.65–0.75; surface area from about 770–830 square meters per gram; pore volume from about 0.39–0.45 cubic meter per gram; pore diameter, mean A. from about 22–26 and particle size such that almost all of a representative sample will pass through a 100 mesh screen and not more than about 12% by volume will be retained on a 200 mesh screen.

Diatomaceous earth or diatomite is essentially silica and is composed of the siliceous skeletons of microscopic aquatic plants, known as diatoms, of the class Bacillariae. They are one-celled plants enclosed in two valves, one overlapping the other. The cell wall is siliceous and hence forms a resistant skeleton. When the plant dies, it sinks to the bottom of the water, where the enclosed organic matter is decomposed, leaving behind the hard siliceous valves. Deposits of diatomaceous earth are made up of great numbers of these diatom valves. Diatomaceous earth, in the preferred form, is white, friable, porous, chalklike material of low apparent density and has the following properties; M.P. 1400–1650° C.; sp. gr. 1.9–2.35; apparent density: of dry lumps 20–40 lb./cu. ft., of dry powder 5–16 lb./cu. ft.; n_D^{20} 1.42–1.48; hardness (Mohs), 1–1.5 (apparent), 4.5–6.5 (actual particles); and particle size such that almost all of a representative sample will pass through a 100 mesh screen and not more than 12% by volume will be retained on a 200 mesh screen. A full description of diatomaceous earth, including chemical analysis, is presented in volume 5 of the Encyclopedia of Chemical Technology at pages 33 to 37.

The synthetic calcium silicates which can be employed in the compositions and method of the invention can be prepared by a hydro-thermal reaction of diatomaceous earth with a source of calcium. These synthetic silicates preferably have a weight ratio of CaO to SiO₂ from about 1:2; a wet density from about 9.5–15 pounds per cubic foot; an ultimate average particle size from about 0.02–0.04 micron; pH from about 8.3–10; and surface area from about 95–175 square meters per gram.

The synthetic calcium silicate employed in certain of the examples hereinafter set forth has the following chemical analysis and physical properties.

TABLE I.—CHEMICAL ANALYSIS

	Percent by wt.
Ignition loss, 1800° F.-----	18.0
CaO -----	25.3
SiO ₂ -----	51.7
Al ₂ O ₃ -----	1.8
Fe ₂ O ₃ -----	0.9
Na ₂ O—K ₂ O -----	0.5

TABLE II.—PHYSICAL PROPERTIES¹

Color -----	Off white.
Loose weight density, lbs./cu. ft.-----	6.
Wet density, lbs./cu. ft.-----	9.5.
Absorption, percent of weight:	
Water -----	475.
Oil -----	425.
Percent retained on 325 mesh, max.-----	6.0
Particle size, average ultimate, microns-----	0.02.
pH -----	8.3
Specific resistivity, ohms-----	2500.
Brightness, TAPPI-----	68.
Surface area, sq. meters/gram-----	95.
Specific gravity-----	2.45.
Refractive index-----	1.55.
Moisture, free, percent by weight-----	6.0.

¹ A calcium silicate having the physical properties set forth in Table II is marketed by the Johns-Manville Corporation under the trade designation Micro-Cel IE.

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In order to prepare the fabric softening compositions of the invention, about 1–70 percent by weight of the fabric softening agent is intimately blended with at least about 30% by weight of a finely divided, highly porous absorbefacient under suitable agitation conditions. In a preferred embodiment, however, about 25–66 percent by weight of the fabric softening agent is blended with the absorbefacient. Since the preferred fabric softening agents tend to be wax-like solids at room temperature, they are, preferably, melted and the molten material is gradually added to the agitated absorbefacient. The agitated product dries in the form of a free-flowing powder. However, for commercial preparation of the fabric softening compositions of the invention, it is preferable to suspend or dissolve the fabric softening agent in a suitable solvent and then blend the latter mixture with the absorbefacient. The solvents which can be effectively employed to dissolve or suspend the fabric softening agent include the lower aliphatic alcohols and the lower alkyl glycol ethers. Water can also be employed in conjunction with these organic solvents. Methyl, ethyl and isopropyl alcohol are among the lower aliphatic alcohols which can be used while methyl, ethyl, propyl and butyl ethers of ethylene glycol are among the lower glycol ethers which can be used. The alcohols and glycol ethers can be employed either separately or in combination and can be used in a concentration up to about 35% by weight of the fabric softening composition. Water can be effectively substituted for up to about 50% by weight of the organic solvents.

The fabric softening compositions of the invention may be added to the rinse cycle in a conventional laundry operation or they may be effectively employed by adding them to a separate bath following the rinse step. The amount of the fabric softening composition which may be added to the bath may vary within wide limits and good results are obtained when the concentration of the fabric softening composition is such that the concentration of the fabric softening agent in the aqueous solution is in the range of about 0.0025–2.0 percent by weight based upon the weight of water. In a preferred embodiment, however, the concentration of the fabric softening composition in the aqueous medium is such that the concentration of the fabric softening agent is in the range of about 0.0025–1.0 percent by weight based upon the weight of the water.

The fabrics, which are to be softened in accordance with the method of the invention, are treated for about 3–15 minutes with a rinse solution containing the fabric softening compositions of the invention in the proportions previously set forth. Although time of treatment is not critical, it should be at least about three minutes, and normally not more than fifteen minutes should be required in order to provide a fabric which has significantly improved properties with respect to uniform softness. For effective results, the rinse bath, containing the fabric softening compositions of the invention, is maintained at a temperature from about 50–120° F. and a pH from about 4.5 to 10.

Fabrics which can be softened in accordance with the method of the invention include, for example, cotton, wool, linen and blends of wood and cotton with natural or synthetic fibers.

A composition of the invention which is particularly adapted for use in the rinse cycle or after rinse bath of a commercial or home laundry operation comprises about 35% by weight of dimethyl distearyl quaternary ammonium chloride, 34% by weight of finely divided, highly porous synthetic calcium silicate, 12% by weight of isopropanol, 6% by weight of the butyl ether of ethylene glycol and 13% by weight of water. The amount of this composition which can be employed in the rinse cycle or after rinse bath is such that the concentration of the quaternary ammonium salt in the rinse is in the range of about 0.0025–1.0 percent by weight based upon

the weight of the rinse liquor, and the concentration of the total composition is in the range of about 0.0072-3.0 percent by weight based upon the weight of the rinse liquor.

The following examples further illustrate various features of the invention.

Example I

This example illustrates the effect of a finely divided, highly porous synthetic calcium silicate on the distribution of dimethyl distearyl ammonium chloride on a muslin fabric.

PART A

100 grams of an isopropanol suspension of dimethyl distearyl ammonium chloride containing 75% solids were placed in an open-top vessel and the vessel with its contents was heated in a forced draft oven maintained at 105° C. until all of the isopropanol had evaporated. The quaternary salt was cooled and ground into a finely divided state.

Two six-inch square swatches of 1.H. muslin were added to one liter of water in a Terg-O-Tometer. The water was maintained at 100° F.; 0.076 gram of the finely divided quaternary salt was added to the Terg-O-Tometer and the muslin swatches were agitated at 60 cycles per minute for five minutes. Upon completion of the five-minute agitation cycle, the swatches were removed from the Terg-O-Tometer, water extracted therefrom, and they were pressed dry.

The uniformity of deposition of the quaternary upon the fabric was determined in accordance with the following procedure: 18 grams of bromophenol blue (tetrabromophenol sulfon-phthalein) were added to a mixture of 11.7 liters of isopropanol and 6.3 liters of deionized water, thereby preparing an approximately 0.1% solution of bromophenol blue. 90 milliliters of the 0.1% bromophenol blue solution were further diluted to 900 milliliters by adding an appropriate amount of deionized water thereto. The swatches, which had been treated with the quaternary in the Terg-O-Tometer, were immersed in the diluted bromophenol blue solution for two minutes with stirring. The swatches were removed from the dye solution and were immersed, successively, in three vessels each of which contained 1 liter of deionized water. Immersion time in the deionized water was one minute for each vessel. After rinsing the swatches in the last vessel of deionized water, the swatches were hydroextracted and pressed dry. Since bromophenol blue is substantive to the quaternary compound deposited upon the fabric and forms a blue color therewith, immersion of the treated fabric in a bromophenol blue solution readily reveals the uniformity and concentration of the quaternary compound upon the fabric.

The muslin swatches, treated with the finely divided quaternary salt and subsequently treated with the bromophenol blue in accordance with the procedure outlined above, had several large and small areas which were not stained by the dye, indicating thereby that the quaternary was irregularly and nonuniformly distributed upon the surface of the swatches.

PART B

100 grams of an isopropanol suspension of dimethyl distearyl ammonium chloride containing 75% solids were placed in an open-top vessel and the vessel with its contents was heated in a forced draft oven maintained at 105° C. until all of the isopropanol had evaporated and until the quaternary ammonium salt was in a molten state. 66 grams of the molten quaternary salt were added to 34 grams of a finely divided, highly porous synthetic calcium silicate. The mixing step was carried out under agitation and, upon cooling, the mixture formed a free-flowing powder. Two six-inch square swatches of muslin were added to 1 liter of water at 100° F. in a Terg-O-Tometer. 0.115 gram of the mixture of the quaternary

ammonium salt and synthetic calcium silicate was added thereto and the muslin swatches were agitated at 60 cycles per minute for five minutes. Upon completion of the five-minute agitation cycle, the swatches were removed from the Terg-O-Tometer, water extracted therefrom, and they were pressed dry. The swatches were treated with a solution of bromophenol blue in accordance with the procedure outlined in Part A. It was observed that the bromophenol blue was uniformly distributed on the surface of the swatches, indicating thereby that the presence of a finely divided, highly porous synthetic calcium silicate promotes the uniform distribution of the cationic softening agent on the fabric.

Example II

This example illustrates the effect of a finely divided, highly porous synthetic calcium silicate on the distribution of 2-heptadecyl-1-methyl-1-[2-formamidoethyl]-imidazolinium methylsulfate on a muslin fabric.

PART A

100 grams of an isopropanol suspension of the above-noted imidazolinium salt containing 75% solids were placed in an open-top vessel and the vessel with its contents was heated in a forced draft oven at 105° C. until all of the alcohol had evaporated. The imidazolinium salt was cooled and ground into a finely divided state. Two six-inch square swatches of muslin were added to 1 liter of water at 100° F. in a Terg-O-Tometer and 0.076 gram of the finely divided imidazolinium salt was added thereto. After agitating the swatches at 60 cycles per minute for five minutes, they were removed from the Terg-O-Tometer and water was extracted therefrom. The swatches were pressed dry and treated with a solution of bromophenol blue in accordance with the procedure outlined in Example I, Part A. It was observed that the swatches had several large and small areas which were not substantive to bromophenol blue. This large number of non-substantive areas indicates that the imidazolinium salt is not being uniformly distributed on the surface of the fabric.

PART B

100 grams of a 75% suspension of the above-defined imidazolinium salt in isopropanol were placed in an open-top vessel and the vessel with its contents was heated in a forced draft oven at 105° C. until all of the isopropanol had evaporated and until the imidazolinium salt was in a molten state. 66 grams of the molten imidazolinium compound were added, under agitation, to 34 grams of a finely divided, highly porous synthetic calcium silicate and, upon cooling, the mixture formed a finely divided, free-flowing powder. Two six-inch square muslin swatches were added to 1 liter of water at 100° F. in a Terg-O-Tometer. 0.115 gram of the finely divided mixture of the imidazolinium salt and synthetic calcium silicate was added to the Terg-O-Tometer and the muslin swatches were agitated at 60 cycles per minute for five minutes. Upon completion of the five-minute agitation cycle, the swatches were removed from the Terg-O-Tometer, water extracted therefrom, and they were pressed dry. The swatches were subsequently treated with bromophenol blue in accordance with the procedure outlined in Example I and it was observed that the blue dye was uniformly distributed on the surface of the fabric indicating thereby that the presence of the synthetic calcium silicate promotes the uniform distribution of the cationic softening agent on the fabric surface.

Example III

This example illustrates that the addition of a synthetic calcium silicate to an isopropanol suspension of dimethyl distearyl ammonium chloride promotes the uniform distribution of this cationic fabric softening agent on a muslin swatch.

A fabric softening composition consisting of 0.076

gram of dimethyl distearyl ammonium chloride and 0.025 gram of isopropanol was added to a Terg-O-Tometer containing two six-inch square swatches of muslin suspended in a liter of water at 100° F. The swatches were agitated for about five minutes, hydroextracted and pressed dry. They were subsequently treated with bromophenol blue in accordance with the procedure outlined in Example I and it was observed that the cationic fabric softener was not uniformly distributed upon the surface of the swatches.

0.051 gram of a finely divided, highly porous synthetic calcium silicate was added to a suspension of 0.076 gram of dimethyl distearyl ammonium chloride in 0.025 gram of isopropanol and the resulting composition was added to a Terg-O-Tometer containing two six-inch square swatches of muslin suspended in a liter of water at 100° F. The swatches were agitated for about five minutes, hydroextracted and pressed dry and subsequently treated with bromophenol blue in accordance with the procedure set forth in Example I. It was observed that the bromophenol blue was uniformly distributed upon the surface of the muslin swatches, thereby indicating that the synthetic calcium silicate promotes the uniform distribution of the cationic fabric softener upon the surface of the muslin swatches.

Example IV

This example corresponds to Example III except that 2-heptadecyl-1-methyl-1-[2-formamidoethyl]-imidazolinium methylsulfate was substituted for the dimethyl distearyl ammonium chloride. It was observed that when the muslin swatches were treated with an isopropanol suspension of the imidazolinium compound and subsequently treated with bromophenol blue, the cationic fabric softening agent was poorly distributed upon the surface of the muslin swatches. However, when the isopropanol suspension of the imidazolinium compound was formulated with a finely divided, highly porous synthetic calcium silicate and the formulated softener employed as the fabric softening composition, it was observed, after treatment with bromophenol blue, that the cationic softening agent was uniformly distributed upon the muslin swatches.

Example V

This example illustrates the effect of synthetic calcium silicate on the distribution of the cationic fabric softening agent on a muslin fabric in the instance where there is accidental spillage of the cationic softening agent on the fabric.

PART A

One liter of softened water at 100° F. was added to a Terg-O-Tometer and two six-inch square muslin swatches were placed in the Terg-O-Tometer such that a portion of each swatch extended above the surface of the water. 0.101 gram of a 75% suspension of dimethyl distearyl ammonium chloride in isopropanol was added directly to the portion of the swatches extending above the surface of the water. The swatches were agitated for five minutes at 60 cycles per minute, hydroextracted for one minute, pressed dry and subsequently treated with bromophenol blue in accordance with the procedure set forth in Example I. After treatment with bromophenol blue, it was observed that the cationic fabric softening agent was highly concentrated in a small area of the swatch, which area corresponded to the area at which the cationic fabric softening agent was directly added.

PART B

Employing the same procedure as set forth in Part A of this example, except that the fabric softening composition consisted of 0.076 gram of dimethyl distearyl ammonium chloride, 0.025 gram of isopropanol and 0.051 gram of a finely divided, highly porous, synthetic calcium silicate, it was observed, after treatment with bromophenol blue, that the cationic fabric softening agent was uniformly distributed upon the surface of the swatches. This example demonstrates that the disadvantages of accidental

spillage of a cationic fabric softening agent upon the fabric can be overcome by the addition thereto of a finely divided, highly porous synthetic calcium silicate.

Example VI

Employing the same procedure and concentration of ingredients as set forth in Example V except that the fabric softening agent was the imidazolinium compound described in Example II, it was observed after treatment with bromophenol blue, that, in the absence of an absorbent such as synthetic calcium silicate, the fabric softening agent was highly concentrated in a small area on the fabric. However, as was true in Example V, this disadvantage brought about by accidental spillage of the cationic fabric softening agent on the fabric was overcome by the addition of a finely divided synthetic calcium silicate to the imidazolinium fabric softening agent.

Example VII

0.262 gram of a fabric softening composition consisting of 29% by weight of dimethyl distearyl ammonium chloride, 9% by weight of isopropanol and 62% by weight of diatomaceous earth was added to a Terg-O-Tometer containing two six-inch square swatches of muslin suspended in a liter of water at 100° F. and the swatches were agitated at 60 cycles per minute for five minutes, hydroextracted, pressed dry and subsequently treated with a solution of bromophenol blue. After treatment with bromophenol blue, it was observed that the cationic fabric softening agent was uniformly distributed upon the surface of the muslin swatches. This example demonstrates, therefore, that the addition of diatomaceous earth to a cationic fabric softening agent promotes the uniform distribution of that softening agent upon a fabric surface.

Example VIII

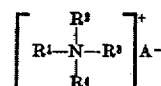
This example illustrates a fabric softening composition which can be advantageously employed in commercial laundries.

35% by weight of dimethyl distearyl ammonium chloride
34% by weight of synthetic calcium silicate
13% by weight of water
12% by weight of isopropanol
6% by weight of butyl ether of ethylene glycol

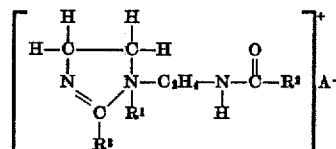
Thus, the objects of this invention have been accomplished, namely, a fabric softening composition has been provided which, when employed in the rinse cycle of a conventional laundry operation, imparts uniform softness to fabrics treated therewith and, in addition, when accidentally spilled upon a portion of the fabric extending above the surface of the rinse bath, does not result in an area or areas of high fabric softening agent concentration after the rinse step.

What is claimed is:

1. A fabric softening composition consisting essentially of about (1) 1-70 percent by weight of a fabric softening agent selected from the group consisting of (1) quaternary ammonium compounds conforming to the following formula:



wherein R¹ and R² are lower alkyl radicals, R³ is a fatty alkyl radical, R⁴ is a member selected from the group consisting of fatty alkyl radicals and aralkyl radicals and A is an anion and (2) imidazolinium compounds conforming to the following formula:

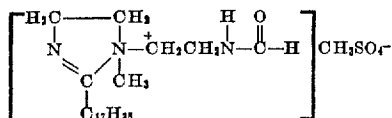


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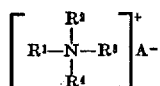
wherein R^1 is a lower alkyl radical, R^2 is a member selected from the group consisting of lower alkyl and hydrogen radicals and R^3 is a fatty alkyl radical and A is an anion, and (II) at least about 30% by weight of a finely divided, highly porous synthetic calcium silicate.

2. A fabric softening composition in accordance with claim 1 wherein said fabric softening agent is dimethyl distearyl ammonium chloride.

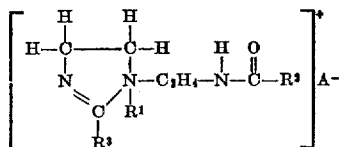
3. A fabric softening composition in accordance with claim 1 wherein said fabric softening agent is 2-heptadecyl - 1 - methyl - 1 - [formamidoethyl] - imidazolinium methylsulfate conforming to the following formula:



4. A fabric softening composition consisting essentially of about 1-70 percent by weight of a fabric softening agent selected from the group consisting of (1) quaternary ammonium compounds conforming to the following formula:



wherein R^1 and R^2 are lower alkyl radicals, R^3 is a fatty alkyl radical, R^4 is a member selected from the group consisting of a fatty alkyl radicals and aralkyl radicals and A is an anion and (2) imidazolinium compounds conforming to the following formula:



wherein R^1 is a lower alkyl radical, R^2 is a member selected from the group consisting of hydrogen and lower alkyl radicals, R^3 is a fatty alkyl radical and A is an anion, in intimate admixture with at least about 30% by weight of a finely divided, highly porous synthetic calcium silicate, wherein up to about 35% by weight of said composition is a solvent selected from the group consisting of lower aliphatic alcohols and lower alkyl glycol ethers in which up to about 50% by weight of said solvent is water.

5. A fabric softening composition in accordance with claim 4 wherein the concentration of the fabric softening agent is in the range of about 25-66 percent by weight.

6. A fabric softening composition in accordance with claim 5 wherein the fabric softening agent is dimethyl distearyl ammonium chloride.

7. A fabric softening composition consisting essentially of about

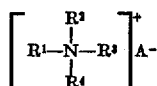
35% by weight of dimethyl distearyl ammonium chloride
34% by weight of finely divided, highly porous, synthetic calcium silicate

13% by weight of water

12% by weight of isopropanol

6% by weight of the butyl ether of ethylene glycol.

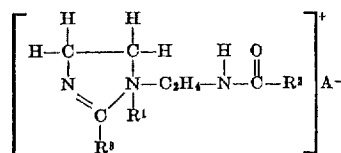
8. A method for imparting uniform softness to fabrics which comprises contacting said fabrics with an aqueous dispersion of a fabric softening composition, said fabric softening composition consisting essentially of about 1-70 percent by weight of a fabric softening agent selected from the group consisting of (1) quaternary ammonium compounds conforming to the following formula:



wherein R^1 and R^2 are lower alkyl radicals, R^3 is a fatty alkyl radical, R^4 is a member selected from the group

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consisting of fatty alkyl radicals and aralkyl radicals and A is an anion and (2) imidazolinium compounds conforming to the following formula:



wherein R^1 is a lower alkyl radical, R^2 is a member selected from the group consisting of hydrogen and lower alkyl radicals and R^3 is a fatty alkyl radical and A is an anion, in intimate admixture with at least about 30% by weight of a finely divided, highly porous synthetic calcium silicate, wherein up to about 35% by weight of said composition is a solvent selected from the group consisting of lower aliphatic alcohols and lower alkyl glycol ethers in which up to about 50% by weight of said solvent is water, wherein the concentration of the fabric softening agent in said aqueous solution is in the range of about 0.0025-2.0 percent by weight based upon the weight of water, whereby uniform softness is imparted to said fabrics.

9. A method in accordance with claim 8 wherein the concentration of the fabric softening agent in said fabric softening composition is in the range of about 25-66 percent by weight.

10. A method in accordance with claim 8 wherein the fabric softening agent is dimethyl distearyl ammonium chloride and the concentration of the softening agent in the aqueous medium is in the range of about 0.005-1.0 percent by weight.

11. In a method of laundering fabrics, the step of imparting uniform softness to laundered fabrics which comprises contacting said laundered fabrics with an aqueous dispersion of about 0.0072 to 3.0 percent by weight, based upon the weight of water, of a fabric softening composition, said fabric softening composition consisting essentially of about:

35% by weight of dimethyl distearyl ammonium chloride
34% by weight of finely divided, highly porous, synthetic calcium silicate

13% by weight of water

12% by weight of isopropanol

6% by weight of the butyl ether of ethylene glycol

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