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(54) Title: LIQUID ANTIPERSPIRANT COMPOSITIONS (57) Abstract Disclosed are clear sprayable liquid antiperspirant compositions having viscosities of less than about 15 centistokes, comprising: an antiperspirant salt which is soluble, and which will remain soluble, in a monohydric alcohol solvent; high levels (30 % or greater) of emollient esters and silicone materials, having viscosities of from about 0.65 centistokes to about 50 centistokes, and solubility parameters of from about 4 to about 10; a surfactant solubilizer which is selected from the group consisting of ethoxylated or propoxylated nonionic surfactants having an HLB of from about 5 to about 18, and mixtures thereof, such that the average HLB of the solubilizer is from about 8 to about 14; and relatively low levels (less than about 50 %) of a monohydric alcohol solvent: wherein the antiperspirant compositions comprise no more than about 5 % water. These antiperspirant compositions provide excellent antiperspirancy and cosmetic in-use properties. They are non-sticky, non-greasy, and quick drying. They stain clothing less than other spray-on liquid antiperspirants. These compositions go onto the skin as a clear spray and leave no white, chalky, residue on skin upon dry down. These antiperspirant compositions also remain stable over time and a broad range of physical conditions, especially ambient temperatures.		

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- 1 -

LIQUID ANTIPERSPIRANT COMPOSITIONS

TECHNICAL FIELD

5 The present invention relates to unique clear, sprayable, liquid antiperspirant compositions having viscosities of less than about 15 centistokes and which provide excellent antiperspirancy and cosmetic in-use properties.

BACKGROUND OF THE INVENTION

10 Antiperspirant compositions have become part of many people's personal care and grooming regimen. The formulation of such compositions, however, generally is an exercise in efficacy and aesthetic trade-offs, with the resulting composition being acceptable overall, but not outstanding. For example, the
15 formulation of a composition to give it good usage aesthetic properties (e.g., minimized residue on the skin, and/or a clean, dry and non-sticky feel) often compromises antiperspirant efficacy. It is particularly difficult to maximize usage aesthetics and efficacy, when creating a low-viscosity liquid
20 product, such as a spray-on antiperspirant composition, and maintain good physical properties (e.g., stability over time and a broad range of physical conditions, especially stability over a broad temperature range).

 Nonaerosol pump spray antiperspirant compositions, in
25 general, are known, having been disclosed in, for example, U.S. Patent 4,053,581, Pader et al., issued October 11, 1977; U.S. Patent 4,065,564, Miles, Jr., issued December 27, 1977; U.S. Patent 4,073,880, Pader et al., issued February 14, 1978; and Great Britain Application 1,536,222, published December 20, 1978.
30 Generally, such compositions comprise high levels of an alcohol solvent. Formulation in such a way generally results in products with poor in-use characteristics, i.e., residue on skin, sticky, cold feel, and stinging upon application.

 Hence, it is an object of the present invention to provide a
35 low viscosity, clear, sprayable, liquid antiperspirant composition

- 2 -

which exhibits excellent antiperspirancy and cosmetic in-use properties.

It is also an object of the present invention to provide a low viscosity, clear, sprayable, liquid antiperspirant composition which is physically and chemically stable over time and a broad range of physical conditions.

These and other objects will become readily apparent from the detailed description which follows.

SUMMARY OF THE INVENTION

The present invention relates to clear, sprayable, liquid antiperspirant solutions, having a viscosity of less than about 15 centistokes, comprising:

- a. from about 10% to about 25% of a monohydric alcohol-soluble antiperspirant salt;
- b. from about 3% to about 10% of a non-volatile silicone emollient having a viscosity of from about 1 centistoke to about 50 centistokes and a solubility parameter of from about 4 to about 9;
- c. from about 5% to about 25% of a volatile silicone emollient having a viscosity of from about 0.65 centistokes to about 10 centistokes and a solubility parameter of from about 4 to about 9;
- d. from about 5% to about 20% of a non-volatile emollient ester having a solubility parameter of from about 7 to about 10;
- e. from about 1% to about 12% of a solubilizer comprising an agent selected from the group consisting of ethoxylated and propoxylated nonionic surfactants having an HLB of from about 5 to about 18, and mixtures thereof;
- f. from about 30% to about 50% of a monohydric alcohol solvent;

wherein the antiperspirant composition comprises no more than about 5% water.

- 3 -

A preferred composition of the present invention comprises a clear, sprayable, liquid antiperspirant solution, having a viscosity of less than about 15 centistokes, comprising:

- 5 a. from about 14% to about 16% of an ethanol-soluble sesquichlorohydrate antiperspirant salt;
 - b. from about 3% to about 10% of a non-volatile silicone emollient selected from the group consisting of phenyl dimethicone, phenyl trimethicone, dimethicone fluids having viscosities of from about 1 centistoke to about 10
10 centistokes, and mixtures thereof;
 - c. from about 10% to about 15% of a volatile silicone emollient selected from the group consisting of D4-D5 cyclomethicones, phenethyl pentamethyl disiloxane, dimethicone fluids having viscosities of less than 1
15 centistoke, and mixtures thereof;
 - d. from about 9% to about 11% of a non-volatile emollient selected from the group consisting of C₁₂-C₁₅ alcohols benzoate, isopropyl myristate, isopropyl palmitate, and mixtures thereof;
 - 20 e. from about 1% to about 2% of a solubilizer which is selected from the group consisting of:
 - A. ethoxylated nonionic surfactant materials selected from the group consisting of compounds of the formula:
$$\text{CH}_3(\text{CH}_2)_x(\text{OCH}_2\text{CH}_2)_n\text{OH}$$

25 wherein x is 12, 14, 16, or 18, and n is 10, and mixtures thereof;
 - B. ethoxylated nonionic surfactant materials selected from the group consisting of compounds of the formula:
$$\text{CH}_3(\text{CH}_2)_x(\text{OCH}_2\text{CH}_2)_n\text{OH}$$

30 wherein x is 12, 14, 16, or 18, and n is 20, and mixtures thereof;
- and mixtures of A and B; such that the average HLB of the solubilizer is from about 8 to about 14, and wherein if A and B are both present, they are at a ratio of A to
35 B of from about 2:1 to about 1:2;

- 4 -

- 5 f. from about 5% to about 8% of a co-solubilizer which is selected from the group consisting of propylene glycol (n) stearyl ether, where n is on the average from 10-16, and propylene glycol (n) myristyl ether, where n is on the average from 2-10, and mixtures thereof; and
- g. from about 43% to about 47% of ethanol;
- wherein the antiperspirant composition comprises no more than about 2.5% water.

DETAILED DESCRIPTION OF THE INVENTION

- 10 The essential as well as optional components of the present compositions are described below.

Antiperspirant Material

- 15 A critical component of the present compositions is an antiperspirant material that is soluble and which remains soluble in ethanol or another suitable monohydric alcohol solvent. Solubilization of the antiperspirant material allows for the formulation of the present clear antiperspirant solutions.

- 20 A variety of publications disclose antiperspirant actives which are soluble in non-aqueous solvents, typically monohydric alcohols (e.g., ethanol). U.S. Patent 3,873,686, Beekman, issued March 25, 1975, (incorporated herein by reference) provides a useful summary of work in this area. The following publications relate to antiperspirant actives soluble in non-aqueous solvents and/or processes for making such actives: U.S. Patent 3,359,169, Slater et al., issued December 19, 1967; U.S. Patent 3,420,932, Jones et al., issued January 7, 1969; U.S. Patent 3,507,896, Jones et al., issued April 21, 1970; U.S. Patent 3,523,130, Jones et al., issued August 4, 1970; U.S. Patent 3,555,146, Jones et al., issued January 12, 1971; U.S. Patent 3,876,758, Beekman, 25 issued April 8, 1975; Great Britain Patent Specifications 1,159,685 and 1,159,686, both published July 30, 1969, Armour Pharmaceutical Company; and European Published Patent Application, 7,191, published January 23, 1980, Unilever Limited.

- 30 U.S. Patent 2,890,987, Hilfer, issued June 16, 1959, describes the preparation of relatively dilute solutions of

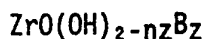
- 5 -

astrigent aluminum compounds in propylene glycol having relatively high water content. U.S. Patent 4,137,306, Rubino et al., issued January 30, 1979, describes anhydrous propylene glycol solutions of alcohol soluble astrigent basic aluminum compounds.

5 Any aluminum astrigent antiperspirant salt or aluminum and/or zirconium astrigent complex that is soluble, and which remains soluble in the present alcohol solvent can be used herein. Salts useful as astrigent antiperspirant salts or as components of astrigent complexes include aluminum halides, aluminum
10 hydroxyhalides, zirconyl oxyhalides, zirconyl hydroxyhalides, and mixtures of these salt materials.

Aluminum salts of this type include aluminum chloride and the aluminum hydroxyhalides having the general formula $Al_2(OH)_xQ_y \cdot xH_2O$ where Q is chloride, bromide, or iodide (preferably chloride); x
15 is from about 2 to about 5, and $x + y =$ about 6, and x and y do not need to be integers; and where x is from about 1 to about 6. Aluminum salts of this type can be prepared in the manner described more fully in U.S. Patent 3,887,692, Gilman, issued June
3, 1975, and U.S. Patent 3,904,741, Jones and Rubino, issued
20 September 9, 1975, incorporated herein by reference.

The zirconium compounds which may be used in the present invention include both zirconium oxy salts and zirconium hydroxy salts, also referred to as the zirconyl salts and zirconyl hydroxy salts. These compounds may be represented by the following
25 general empirical formula:



wherein z may vary from about 0.9 to about 2 and need not be an integer; n is the valence of B; $2-nz$ is greater than or equal to 0; and B may be selected from the group consisting of halides
30 (preferably chloride), nitrate, sulfamate, sulfate, and mixtures thereof. Although only zirconium compounds are exemplified in this specification, it will be understood that other Group IVB metal compounds, including hafnium, could be used in the present invention.

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- 6 -

As with the basic aluminum compounds, it will be understood that the above formula is greatly simplified and is intended to represent and include compounds having coordinated and/or bound water in various quantities, as well as polymers, mixtures and complexes of the above. As will be seen from the above formula, the zirconium hydroxy salts actually represent a range of compounds having various amounts of the hydroxy group, varying from about 1.1 to only slightly greater than 0 groups per molecule.

Several types of antiperspirant complexes utilizing the above antiperspirant salts are known in the art. For example, U.S. Patent 3,792,068, Luedders et al., issued February 12, 1974, discloses complexes of aluminum, zirconium, and amino acids such as glycines. Complexes such as those disclosed in the Luedders et al. patent and other similar complexes are commonly known as ZAG. ZAG complexes are chemically analyzable for the presence of aluminum, zirconium, and chlorine. ZAG complexes useful herein are identified by the specification of both the molar ratio of aluminum to zirconium (hereinafter "Al:Zr" ratio) and the molar ratio of total metal to chlorine (hereinafter "Metal:Cl" ratio). ZAG complexes useful herein have an Al:Zr ratio of from about 1.67 to about 12.5 and a Metal:Cl ratio of from about 0.73 to about 1.93.

Preferred ZAG complexes are formed by

(A) co-dissolving in water

(1) one part $\text{Al}_2(\text{OH})_{6-m}\text{Q}_m$, wherein Q is an anion selected from the group consisting of chloride, bromide, and iodide; and m is from about 0.8 to about 2.0;

(2) x parts $\text{ZrO}(\text{OH})_{2-a}\text{Q}_a \cdot n\text{H}_2\text{O}$, where q is chloride, bromide, or iodide; a is from about 1 to about 2; n is from about 1 to about 8; and x is from about 0.16 to about 1.2;

(3) p parts neutral amino acid selected from the group consisting of glycine, dl-tryptophane, dl- β -phenylalanine, dl-valine, dl-methionine, and β -alanine, and

- 7 -

where p is from about 0.06 to about 0.53;

(B) codrying the resultant mixture to a friable solid; and

(C) reducing the resultant dried inorganic-organic antiperspirant complex to a particulate form.

5 A preferred aluminum compound for preparation of such ZAG type complexes is aluminum chlorhydroxide of the empirical formula $Al_2(OH)_5Cl \cdot 2H_2O$. Preferred zirconium compounds for preparation of such ZAG-type complexes are zirconyl hydroxychloride having the empirical formula $ZrO(OH)Cl \cdot 3H_2O$ and the zirconyl hydroxyhalides
10 of the empirical formula $ZrO(OH)_{2-a}Cl_a \cdot nH_2O$ wherein a is from about 1.5 to about 1.87, and n is from about 1 to about 7. The preferred amino acid for preparing such ZAG-type complexes is glycine of the formula $CH_2(HN_2)COOH$. Salts of such amino acids can also be employed in the antiperspirant complexes. See U.S.
15 Patent 4,017,599, Rubino, issued April 12, 1977, incorporated herein by reference.

A wide variety of other types of antiperspirant complexes are also known in the art. For example, U.S. Patent 3,903,258, Siegal, issued September 2, 1975, discloses a zirconium aluminum
20 complex prepared by reacting zirconyl chloride with aluminum hydroxide and aluminum chlorhydroxide. U.S. Patent 3,979,510, Rubino, issued September 7, 1976, discloses an antiperspirant complex formed from certain aluminum compounds, certain zirconium compounds, and certain complex aluminum buffers. U.S. Patent
25 3,981,896, issued September 21, 1976, discloses an antiperspirant complex prepared from an aluminum polyol compound, a zirconium compound and an organic buffer. U.S. Patent 3,970,748, Mecca, issued July 20, 1976, discloses an aluminum chlorhydroxy glycinate complex of the appropriate general formula $[Al_2(OH)_4Cl][H_2CNH_2-COOH]$. All of these patents are incorporated by reference herein.
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Of all of the above types of antiperspirant actives, preferred compounds include the 5/6 basic aluminum salts of the empirical formula $Al_2(OH)_5Cl \cdot 2H_2O$; mixtures of $AlCl_3 \cdot 6H_2O$ and $Al_2(OH)_5Cl \cdot 2H_2O$ with aluminum chloride to aluminum hydroxychloride
35 weight ratios of up to about 0.5; ZAG type complexes wherein the

- 8 -

zirconium salt is $\text{ZrO}(\text{OH})\text{Cl}\cdot 3\text{H}_2\text{O}$, the aluminum salt is $\text{Al}_2(\text{OH})_5\text{Cl}\cdot 2\text{H}_2\text{O}$ or the aforementioned mixtures of $\text{AlCl}_3\cdot 6\text{H}_2\text{O}$ and $\text{Al}_2(\text{OH})_5\text{Cl}\cdot 2\text{H}_2\text{O}$ wherein the total metal to chloride molar ratio in the complex is less than about 1.25 and the Al:Zr molar ratio is about 3.3, and the amino acid is glycine; and the ZAG-type complexes wherein the zirconium salt is $\text{ZrO}(\text{OH})_2\cdot a\text{Cl}_a\cdot n\text{H}_2\text{O}$ wherein a is from about 1.5 to about 1.87 and n is from about 1 to about 7, the aluminum salt is $\text{Al}_2(\text{OH})_5\text{Cl}\cdot 2\text{H}_2\text{O}$, and the amino acid is glycine.

The most preferred antiperspirant actives useful in the compositions of the present invention are antiperspirant actives with enhanced efficacy due to improved molecular distribution. Aluminum chlorhydroxide salts, zirconyl hydroxychloride salts, and mixtures thereof having improved molecular distributions are known, having been disclosed, for example, in the following documents, all incorporated by reference herein: U.S. Patent 4,359,456, Gosling et al., issued November 16, 1982; European Published Patent Application 6,739, Unilever Ltd., published January 9, 1980; European Published Patent Application, 183,171, Armour Pharmaceutical Company, published June 4, 1986; British Patent Specification 2,048,229, The Gillette Company, published December 10, 1980; European Published Patent Application 191,628, Unilever PLC, published August 20, 1986; and British Patent Specification 2,144,992, The Gillette Company, published March 20, 1985.

The improved molecular distribution is determined by the known analysis method called gel permeation chromatography. This analysis method is described, for example, in several of the above-incorporated patent specifications as well as in European Published Patent Application 7,191, Unilever Ltd., published January 23, 1980, the disclosures of which are incorporated herein. It is preferred for purposes of the present invention that the antiperspirant actives utilized have enhanced efficacy due to improved molecular distribution with a ratio of peak 4 to peak 3 greater than about 0.1:1 as determined by gel permeation chromatography. This ratio, as is recognized by one skilled in

- 9 -

the art, relates to the relative area under those two peaks as measured by the gel permeation chromatography analysis method.

Highly desirable antiperspirant salts for use herein are selected from the group consisting of aluminum chlorohydrate (sold under the name Rehydrol®, by Reheis Chemical Company), aluminum chlorohydrate PEG, aluminum chlorohydrate PG, aluminum sesquichlorohydrate, aluminum sesquichlorohydrate PEG, aluminum sesquichlorohydrate PG, and mixtures thereof. All of these materials are particularly safe for use in spray-on compositions. The most preferred antiperspirant salt for use herein is aluminum sesquichlorohydrate.

U.S. Patent 4,053,581, Pader et al., issued October 11, 1977; U.S. Patent 4,065,564, Miles Jr. et al., issued December 27, 1977; and U.S. Patent 4,073,880, Pader et al., issued February 14, 1978; all disclose formulations for pump-spray or roll-on antiperspirants comprising alcohol-soluble aluminum chlorohydroxide antiperspirant salts, an alcohol vehicle, and silicone materials.

The antiperspirant salt is present in the liquid antiperspirant compositions of the present invention at a level of from about 10% to about 25%, preferably from about 14% to about 16%. These weight percentages are calculated on an anhydrous metal salt basis (exclusive of glycine, the salts of glycine, or other complexing agents).

Solvent for the Antiperspirant Salt

The antiperspirant salts of the present invention are solubilized in a solvent. Suitable solvents include monohydric alcohols, especially C₂-C₄ monohydric alcohols. The preferred solvent for use herein is ethanol. A small amount of water is also necessary in the present compositions to solubilize the antiperspirant material. However, the present compositions will comprise no more than about 5%, preferably no more than about 2.5%, water.

The solvent is present in the compositions of the present invention at a level at least sufficient to solubilize the antiperspirant salt. It is desirable to keep the level of

- 10 -

monohydric alcohol solvent in the present compositions low to allow for the incorporation of as much emollient materials as possible. This results in a product with improved in-use characteristics. Generally, the solvent is present in the compositions at a level of from about 30% to about 50%, preferably from about 43% to about 47%.

Emollients

The present antiperspirant composition also comprise large amounts of non-volatile emollient esters and volatile and non-volatile silicone emollients. It is these components that are primarily responsible for the desirable product aesthetics and in-use characteristics of the present compositions. For example, these components provide the smooth, clean, dry, non-sticky feel upon application to the skin. These components are present in the antiperspirant compositions at relatively high levels to maximize these benefits. Generally, these components are present at a total level of from about 20% to about 35%, preferably from about 24% to about 33%. These emollient materials must have a viscosity in the range of from about 0.65 centistokes to about 50 centistokes as measured by a Brookfield® cone and plate viscometer, at ambient temperature (or other suitable methods). These emollient materials must also be of a certain polarity to remain stable in the present compositions. i.e., they must have a solubility parameter (units equal $(\text{cal}/\text{cm}^3)^{1/2}$) in the range of from about 4 to about 10, preferably from about 5 to about 9.

The solubility parameter is defined in the *Polymer Handbook* 3rd Ed. (John Wiley and Sons, New York), J Brandrup and E.H. Immergut, Chapter VII, PP. 519-559, as the square root of the cohesive energy density and describes the attractive strength between molecules of the material. Solubility parameters may be determined by measurement, correlations with other physical properties, or indirect measurement. The solubility parameters for the present emollient materials were determined by surface tension measurement as outlined in Vaughan, C.D., *J. Soc. Cosmet. Chem.*, 36, 319-333, 1985.

- 11 -

Part of the emollient material of the present compositions comprises a non-volatile emollient ester. This material may comprise C₁₂-C₁₅ alcohol benzoates; esters, diesters, or tetra-esters of C₂-C₂₀ alcohols and C₆-C₁₆ fatty acids (e.g. diisopropyl sebacate, diisopropyl adipate, lauryl lactate, myristyl myristate, and pentaerythrityl tetrapelargonate); and mixtures thereof, which meet the solubility parameter requirement described above. The preferred of these non-volatile emollient materials are esters, diesters, and tetraesters of C₂-C₂₀ alcohols and C₆-C₁₆ fatty acids. Especially preferred are isopropyl myristate, isopropyl palmitate, C₁₂-C₁₅ alcohols benzoate, and mixtures thereof. The most preferred of these emollient esters for use herein are C₁₂-C₁₅ alcohols benzoate.

Generally, from about 5% to about 20%, preferably from about 9% to about 11%, of the present compositions comprise these non-volatile emollient ester materials. The non-volatile emollient ester component of the present compositions has a solubility parameter of from about 7 to about 10.

The emollient material of the antiperspirant compositions of the present invention also comprises silicone emollient materials. Of course the silicone emollient materials used herein must also meet the particular emollient viscosity and solubility parameter requirements as outlined above.

Various types of silicone materials have been disclosed for use in various forms of antiperspirant compositions. For example, U.S. Patent 4,784,844, Thimineur et al., issued November 15, 1988; U.S. Patent 4,499,069, Krafon, issued February 12, 1985; U.S. Patent 4,268,499, Keil, issued May 19, 1981; U.S. Patent 4,264,586, Callingham et al., issued April 28, 1981; U.S. Patent 4,053,581, Pader et al., issued October 11, 1977; U.S. Patent 4,065,564, Miles, Jr. et al., issued December 27, 1977; U.S. Patent 4,073,880, Pader et al., issued February 14, 1978; U.S. Patent 4,673,570, Soldati, issued June 16, 1987; U.S. Patent 4,559,226, Fogel, issued December 17, 1985; U.S. Patent 4,435,382, Shin et al., issued March 6, 1984; European Patent Office

- 12 -

Application 343,843, published November 29, 1989; Great Britain Patent Application 1,536,222, published December 20, 1978; Great Britain Patent Application 2,018,590, published October 24, 1979; and Japanese Published Patent Application 59-152,318, published August 31, 1984.

5 The silicone emollient materials of the present compositions comprise a volatile silicone emollient, having a viscosity of from about 0.65 centistokes to about 10 centistokes, and a solubility parameter of from about 4 to about 9. Certain volatile silicone materials, such as cyclic polydimethylsiloxanes containing from about 3 to about 7 silicon atoms, meet these requirements and are useful herein. A description of volatile silicones is found in Todd and Byers, "Volatile Silicone Fluids for Cosmetics", *Cosmetics and Toiletries*, 91:27-32 (1976), incorporated herein by reference. Other volatile silicones useful herein are taught in U.S. Patent 4,874,868, Bolich, Jr., issued October 17, 1989, incorporated by reference herein. A preferred volatile silicone for use in the present compositions, which is covered in that patent, is phenethyl pentamethyl disiloxane.

15 20 The present compositions comprise from about 5% to about 25%, preferably from about 10% to about 15%, of these volatile silicone materials. The preferred volatile silicone emollient materials of the present invention are D4-D5 cyclomethicones, phenethyl pentamethyl disiloxane, and mixtures thereof.

25 Additionally, the present compositions may comprise a volatile dimethicone fluid emollient material, having a viscosity of less than 1 centistoke, preferably 0.65 centistoke, at a level of from about 2% to about 5% of the composition.

30 The silicone emollient materials of the present compositions also comprise non-volatile silicone emollient materials. Such materials have a viscosity of from about 1 to about 50 centistokes, and a solubility parameter of from about 4 to about 9. The present compositions comprise from about 3% to about 10%, preferably from about 3% to about 5%, of such materials. Preferably, such materials comprise phenyl dimethicone, phenyl

- 13 -

trimethicone, non-volatile dimethicone fluids having a viscosity of from about 1 centistoke to about 10 centistokes, and mixtures thereof.

Surfactant Solubilizer

5 Because the level of emollients is relatively high in the present liquid antiperspirant compositions, formulation of the compositions so that they remain physically and chemically stable over time and a broad range of physical conditions (especially variability in ambient temperature) requires incorporation of
10 certain surfactant solubilizers.

 These solubilizers are primarily responsible for providing product stability. The surfactant solubilizers of the present invention must be soluble in the antiperspirant solvent, must have a low skin irritation potential, must be able to solubilize large
15 amounts of oil phase at temperatures ranging from about -20°C to about 60°C, must have an average HLB in the range of from about 8 to about 14, and must, of course, have a low base odor. HLB is fully described, and HLB values for various materials are provided in the publication *The HLB System, A Time-Saving Guide to*
20 *Emulsifier Selection* (published by ICI Americas Inc., Wilmington, DE; 1984), the disclosure of this publication being incorporated by reference herein.

 Silicone-in-water emulsions stabilized by nonionic surfactant emulsifiers having certain HLB values are known, having been
25 disclosed in such references as U.S. Patent 4,874,547, Narula, issued October 17, 1989; U.S. Patent 4,788,001, Narula, issued November 29, 1988; and Great Britain Patent Publication 2,155,337, published September 25, 1985.

 The present antiperspirant compositions comprise from about
30 1% to about 12%, preferably from about 1% to about 2%, of a surfactant solubilizer.

 The solubilizer of the present invention comprises, as a critical component, ethoxylated or propoxylated nonionic surfactant materials, and mixtures thereof. More specifically,
35 the solubilizer comprises an agent selected from the group

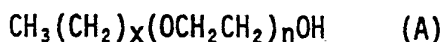
- 14 -

consisting of ethoxylated and propoxylated nonionic surfactants having an HLB in the range of from about 5 to about 18, or mixtures thereof; such that the average HLB of the solubilizer is from about 8 to about 14. Hence, a single solubilizer material
5 may be used which itself has an HLB in the range of from about 8 to about 14. Alternatively, a mixture of materials may be used as the solubilizer herein, each having an HLB in the range of from about 5 to about 18, such that the average HLB of the mixture is from about 8 to about 14. Surfactant materials, or mixtures of
10 surfactant materials, with an HLB in this range, provide stability across a broad temperature range. Most preferably, these solubilizer materials are selected from the group consisting of ethoxylated or propoxylated fatty acid ethers, and mixtures thereof, so that the average HLB of the solubilizer is from about
15 8 to about 14.

Examples of solubilizer materials which meet these requirements and, hence, are useful in the present invention include Oleth-5, Oleth-10, Oleth-20, Laureth-4, Laureth-7, Laureth-10, Laureth-12, Laureth-23, Steareth-2, Steareth-10,
20 Steareth-20, Steareth-21, Cetareth-10, Cetareth-20, Ceteth-10, Ceteth-20, and mixtures thereof.

Ethoxylated or propoxylated fatty acid ethers, and mixtures thereof, have been disclosed for use as emulsifiers in antiperspirant compositions. U.S. Patent 4,784,844, Thimineur et
25 al., issued November 15, 1988, discloses silicone-in-water emulsions containing highly ethoxylated nonionic emulsifiers such as Ceteth-20. U.S. Patent 4,499,069, Krafton, issued February 12, 1985; U.S. Patent 4,268,499, Keil, issued May 19, 1981; and U.S. Patent 4,264,586, Callingham et al., issued April 28, 1981; also
30 disclose the use of such materials in antiperspirant compositions.

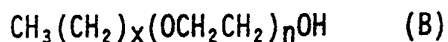
Highly preferred surfactant solubilizers of the present invention comprise from about 1% to about 2% of materials selected from the group consisting of compounds of the formula:



35 wherein x is 12, 14, 16, or 18, and n is 10, and mixtures thereof;

- 15 -

and compounds of the formula:



wherein x is 12, 14, 16, or 18, and n is 20, and mixtures thereof; and mixtures of A and B; such that the average HLB of the solubilizer is from about 8 to about 14, and wherein if A and B are both present, they are at a ratio of A to B of from about 2:1 to about 1:2.

Especially preferred solubilizers for use in the present invention comprise, Steareth-20 alone, at a level of from about 1% to about 2%; or a combination of Ceteth-10 and Ceteth-20, at a ratio of about 1:1, and at a total level of from about 1% to about 2%.

The compositions of the present invention can also comprise from about 5% to about 8% of other co-solubilizer surfactants. For example, polypropylene glycol ("PPG") ethers of C_4 - C_{22} (preferably C_{10} - C_{20}) fatty alcohols may be included in the present compositions. Examples of such materials include PPG-2 myristyl ether, PPG-4 lauryl ether, PPG-10 cetyl ether, PPG-3 myristyl ether, PPG-11 stearyl ether, PPG-15 stearyl ether and mixtures thereof. Additional examples are found in *CTFA Cosmetic Ingredient Dictionary*, Third Edition (Extrin et al., Editors; The Cosmetic, Toiletry and Fragrance Association, Inc., 1982), pages 252-260 and 494-500, the disclosures of which are incorporated by reference herein. Preferred co-solubilizers of the present compositions are selected from the group consisting of propylene glycol (n) stearyl ether, where n is on the average from 10-16; and propylene glycol (n) myristyl ether, where n is on the average from 2-10; and mixtures thereof. Most preferred in the present compositions is PPG-3 myristyl ether (HLB about 9.8).

Optional components

The compositions of the present composition may also comprise a number of optional components to provide cosmetic or aesthetic benefits. For example, preservatives, deodorant actives, such as anti-microbials or bacteriocides, perfumes, coloring agents and dyes may be used.

- 16 -

These optional components must be chosen so as not to interfere with the antiperspirant efficacy and the composition stability. These optional components are generally present in the compositions of the present invention at a level of from about 0.01% to about 10%.

Products

The present compositions are preferably in the form of a low-viscosity non-aerosol pump spray. However, the present invention is applicable to other liquid antiperspirant product types, such as aerosol or roll-on product types. Products formulated as aerosols will also comprise a propellant material. Any of the commonly used propellants in the antiperspirancy art are suitable. Products formulated as roll-ons will also comprise a thickening agent to raise the viscosity of the composition. Suitable thickening agents include carboxymethyl cellulose, clay thickeners, colloidal silica, and Microthene® beads, manufactured by U.S.I. Chemicals, having a mean particle diameter of less than about 20 microns.

Methods of Manufacture

The antiperspirant compositions of the present invention may be manufactured using methods known in the art. In making the compositions, the antiperspirant salt is first solubilized in the monohydric alcohol solvent, and a small amount of water (no more than 5% water, by weight of the antiperspirant composition) to form a clear solution. The remaining components are then added to the composition using conventional formulation methods.

Method for Preventing Perspiration and Malodor

The present invention also provides methods for treating or preventing perspiration and malodor associated with human underarm perspiration. These methods comprise applying a safe and effective amount of the liquid antiperspirant compositions of the present invention to the skin in the axillary area of a human. The term a "safe and effective amount" as used herein, is an amount which is effective in eliminating or substantially reducing the production of perspiration which ultimately generates the

- 17 -

malodors detected through formation of pungent fatty acids, while being safe for human use at a reasonable risk/benefit ratio.

5 The liquid antiperspirant compositions of the present invention provide excellent cosmetic attributes both on application and throughout use. They are non-sticky, non-greasy, and quick drying. The compositions stain clothing less than other liquid spray-on antiperspirant compositions. In addition, the present compositions leave no white, chalky residue on skin upon dry down.

10 The following examples illustrate the present invention. It will be appreciated that other modifications of the present invention within the skill of those in the antiperspirant formulation art can be undertaken without departing from the spirit and scope of this invention.

15 All parts, percentages, and ratios herein are by weight unless otherwise specified.

Example I

The following is a clear, liquid, spray-on antiperspirant composition representative of the present invention.

20	<u>Component</u>	<u>Weight %</u>
	Aluminum Sesquichlorohydrate	15.00
	SD Alcohol 40	46.00
	D4 Cyclomethicone	10.00
	C ₁₂ -C ₁₅ Alcohols Benzoate ¹	10.00
25	PPG-3 Myristyl Ether	6.50
	Phenyl Dimethicone	4.00
	Dimethicone Fluid (5 ctsk)	3.50
	DRO Water	2.50
	Steareth-20	2.00
30	Perfume	0.50
	Total=100.00	

¹Available under the trade name Finsolv TN® from Finetex, Inc.

35 The composition is prepared as follows. An aluminum sesquichlorohydrate (ASQCH) premix is prepared by combining the

- 18 -

ASQCH, about 2/3 of the ethanol and the DRO water. The main mix is then prepared by adding to the ASQCH premix the remaining ethanol, the D4 cyclomethicone, the C₁₂-C₁₅ alcohols benzoate, the PPG-3 myristyl ether, the phenyl dimethicone, the dimethicone fluid, the Steareth-20, and the perfume, in that order.

The resulting antiperspirant composition provides excellent antiperspirancy efficacy with good product aesthetics and in-use characteristics. The composition also remains stable over time and broad ranges of physical conditions, especially ambient temperatures.

Example II

The following is a clear liquid spray-on antiperspirant composition representative of the present invention.

<u>Component</u>	<u>Weight %</u>
Aluminum Sesquichlorohydrate Premix	50.00
Ethanol	14.00
Ceteth-10	0.92
Ceteth-20	1.08
PPG-15 Stearyl Ether	4.00
Isopropyl Myristate	10.00
Phenethyl Pentamethyl Disiloxane	6.00
D4 Cyclomethicone	14.00
	Total=100.00
Aluminum Sesquichlorohydrate Premix	
<u>Component</u>	<u>Weight %</u>
Aluminum Sesquichlorohydrate	30.0
Ethanol	65.0
DRO Water	5.0
	Total=100.0

This composition is prepared as follows. The aluminum sesquichlorohydrate (ASQCH) premix is prepared by combining the ASQCH, ethanol and water. The main mix is then prepared by adding to the ASQCH premix the remaining ethanol, the Ceteth-10, the Ceteth-20, the PPG-15 stearyl ether, the isopropyl myristate, the

- 19 -

phenethyl pentamethyl disiloxane, and the D4 cyclomethicone, in that order.

The resulting antiperspirant composition provides excellent antiperspirancy efficacy with good product aesthetics and in-use characteristics. The composition also remains stable over time and broad ranges of physical conditions, especially ambient temperatures.

Example III

The following is a clear liquid spray-on antiperspirant composition representative of the present invention.

	<u>Component</u>	<u>Weight %</u>
	Aluminum Sesquichlorohydrate Premix	50.00
	Ethanol	13.50
	Ceteth-10	0.92
15	Ceteth-20	1.08
	PPG-3 Myristyl Ether	6.50
	C ₁₂ -C ₁₅ Alcohols Benzoate ¹	10.00
	Perfume	0.40
	Phenyl Dimethicone	4.00
20	Dimethicone Fluid (5 cstk)	3.50
	D4 Cyclomethicone	10.10
	Total=100.00	

¹Available under the trade name Finsolv TN[®] from Finetex, Inc.

25	Aluminum Sesquichlorohydrate Premix	
	<u>Component</u>	<u>Weight %</u>
	Aluminum Sesquichlorohydrate	30.0
	Ethanol	65.0
	DRO Water	5.0
30	Total=100.0	

This composition is prepared as follows. The aluminum sesquichlorohydrate (ASQCH) premix is prepared by combining the ASQCH, ethanol and water. The main mix is then prepared by adding to the ASQCH premix the remaining ethanol, the Ceteth-10, the Ceteth-20, the PPG-3 myristyl ether, the C₁₂-C₁₅ alcohols

- 20 -

benzoate, the perfume, the phenyl dimethicone, the dimethicone fluid, and the D4 cyclomethicone, in that order.

5 The resulting antiperspirant composition provides excellent antiperspirancy efficacy with good product aesthetics and in-use characteristics. The composition also remains stable over time and broad ranges of physical conditions, especially ambient temperatures.

Example IV

10 The following is a liquid antiperspirant composition representative of the present invention.

	<u>Component</u>	<u>Weight %</u>
	Aluminum Sesquichlorohydrate Premix	50.00
	Ethanol	13.50
	Steareth-20	1.00
15	PPG-3 Myristyl Ether	6.50
	C ₁₂ -C ₁₅ Alcohols Benzoate	10.00
	Perfume	0.40
	Phenyl Dimethicone	4.00
	Dimethicone Fluid (5 cstk)	3.50
20	D4 Cyclomethicone	11.10
	Total=100.00	

	Aluminum Sesquichlorohydrate Premix	
	<u>Component</u>	<u>Weight %</u>
	Aluminum Sesquichlorohydrate	30.0
25	Ethanol	65.0
	DRO Water	5.0
	Total=100.0	

30 This composition is prepared as follows. The aluminum sesquichlorohydrate (ASQCH) premix is prepared by combining the ASQCH, ethanol and water. The main mix is then prepared by adding to the ASQCH premix the remaining ethanol, the Steareth-20, the PPG-3 myristyl ether, the C₁₂-C₁₅ alcohols benzoate, the perfume, the phenyl dimethicone, the dimethicone fluid, and the D4 cyclomethicone, in that order.

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- 21 -

The resulting antiperspirant composition provides excellent antiperspirancy efficacy with good product aesthetics and in-use characteristics. The composition also remains stable over time and broad ranges of physical conditions, especially ambient temperatures.

Example V

The following is a liquid antiperspirant composition representative of the present invention.

	<u>Component</u>	<u>Weight %</u>
10	Aluminum Sesquichlorohydrate Premix	50.00
	Ethanol	13.00
	Ceteth-10	0.92
	Ceteth-20	1.08
	Benzalkonium Chloride ¹	0.25
15	PPG-3 Myristyl Ether	6.50
	C ₁₂ -C ₁₅ Alcohols Benzoate	10.00
	Phenethyl Pentamethyl Disiloxane	6.00
	D4 Cyclomethicone	12.25
	Total=100.00	

20 ¹Antimicrobial, available from Lonza, Inc., under the trade name - Barquat MB-80®

Aluminum Sesquichlorohydrate Premix

	<u>Component</u>	<u>Weight %</u>
	Aluminum Sesquichlorohydrate	30.0
25	Ethanol	65.0
	DRO Water	5.0
	Total=100.0	

This composition is prepared as follows. The aluminum sesquichlorohydrate (ASQCH) premix is prepared by combining the ASQCH, ethanol and water. The main mix is then prepared by adding to the ASQCH premix the remaining ethanol, the Ceteth-10, the Ceteth-20, the Barquat MB-80®, the PPG-3 myristyl ether, the C₁₂-C₁₅ alcohols benzoate, the phenethyl pentamethyl disiloxane, and the D4 cyclomethicone, in that order.

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- 22 -

5 The resulting antiperspirant composition provides excellent antiperspirancy efficacy with good product aesthetics and in-use characteristics. The composition also remains stable over time and broad ranges of physical conditions, especially ambient temperatures.

Example VI

The following is a liquid antiperspirant composition representative of the present invention.

	<u>Component</u>	<u>Weight %</u>
10	Aluminum Sesquichlorohydrate Premix	50.00
	Ethanol	14.50
	Steareth-20	2.00
	PPG-3 Myristyl Ether	6.50
	C ₁₂ -C ₁₅ Alcohols Benzoate	11.00
15	Fragrance	0.50
	Dimethicone Fluid (5 centistokes)	5.00
	D4 Cyclomethicone	10.50
	Total=100.00	
	Aluminum Sesquichlorohydrate Premix	
20	<u>Component</u>	<u>Weight %</u>
	Aluminum Sesquichlorohydrate	30.0
	Ethanol	65.0
	DRO Water	5.0
	Total=100.0	

25 This composition is prepared as follows. The ASQCH premix is prepared by combining the ASQCH, ethanol and water. The main mix is then prepared by adding to the ASQCH premix the remaining ethanol, the Steareth-20, the PPG-3 myristyl ether, the C₁₂-C₁₅ alcohols benzoate, the fragrance, dimethicone fluid, and the D4
30 cyclomethicone, in that order.

The resulting antiperspirant composition provides excellent antiperspirancy efficacy with good product aesthetics and in-use characteristics. The composition also remains stable over time and broad ranges of physical conditions, especially ambient
35 temperatures.

- 23 -

Example VII

The following is a liquid antiperspirant composition representative of the present invention.

	<u>Component</u>	<u>Weight %</u>
5	Aluminum Sesquichlorohydrate Premix	50.00
	Ethanol	13.50
	Steareth-20	2.00
	PPG-3 Myristyl Ether	6.50
	C ₁₂ -C ₁₅ Alcohols Benzoate	11.00
10	Fragrance	0.50
	Dimethicone Fluid (5 centistokes)	4.00
	D4 Cyclomethicone	12.50
	Total=100.00	

Aluminum Sesquichlorohydrate Premix

15	<u>Component</u>	<u>Weight %</u>
	Aluminum Sesquichlorohydrate	30.0
	Ethanol	65.0
	DRO Water	5.0
	Total=100.0	

20 This composition is prepared as follows. The ASQCH premix is prepared by combining the ASQCH, ethanol and water. The main mix is then prepared by adding to the ASQCH premix the remaining ethanol, the Steareth-20, the PPG-3 myristyl ether, the C₁₂-C₁₅ alcohols benzoate, the fragrance, the dimethicone fluid, and the

25 D4 cyclomethicone, in that order.

The resulting antiperspirant composition provides excellent antiperspirancy efficacy with good product aesthetics and in-use characteristics. The composition also remains stable over time and broad ranges of physical conditions, especially ambient

30 temperatures.

WHAT IS CLAIMED IS:

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- 24 -

CLAIMS

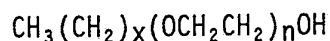
1. A clear, sprayable, liquid antiperspirant solution, having a viscosity of less than about 15 centistokes, characterized in that it comprises:
 - a. from 10% to 25%, preferably from 14% to 16%, of a monohydric alcohol-soluble antiperspirant salt, said monohydric alcohol-soluble antiperspirant salt preferably being selected from the group consisting of aluminum chlorohydrate, aluminum chlorohydrate PEG, aluminum chlorohydrate PG, aluminum sesquichlorohydrate, aluminum sesquichlorohydrate PEG, aluminum sesquichlorohydrate PG, and mixtures thereof, and more preferably being an ethanol-soluble aluminum sesquichlorohydrate antiperspirant;
 - b. from 3% to 10%, preferably 3% to 5%, of a non-volatile silicone emollient having a viscosity of from 1 centistoke to 50 centistokes and a solubility parameter of from 4 to 9, said non-volatile silicone emollient preferably being selected from the group consisting of phenyl dimethicone, phenyl trimethicone, dimethicone fluids having viscosities of from 1 centistoke to 10 centistokes, and mixtures thereof;
 - c. from 5% to 25%, preferably 10% to 15%, of a volatile silicone emollient having a viscosity of from about 0.65 centistokes to 10 centistokes and a solubility parameter of from 4 to 9, said volatile silicone emollient preferably being selected from the group consisting of D4-D5 cyclomethicones, phenethyl pentamethyl disiloxane, dimethicone fluids having viscosities of less than 1 centistoke, and mixtures thereof.
 - d. from 5% to 20%, preferably 9% to 11%, of a non-volatile emollient ester having a solubility parameter of from 7 to 10, said nonvolatile emollient preferably being from

- 25 -

the group consisting of C₁₂-C₁₅ alcohols benzoate, isopropyl myristate, isopropyl palmitate, and mixtures thereof;

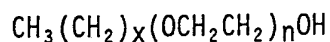
- e. from 1% to 12%, preferably 1% to 2%, of a solubilizer comprising an agent selected from the group consisting of ethoxylated and propoxylated nonionic surfactants, having an HLB of from 5 to 18, and mixtures thereof, such that the average HLB of the solubilizer is from 8 to 14; said solubilizer preferably being selected from ethoxylated and propoxylated fatty acid selected from the group consisting of:

- A. ethoxylated nonionic surfactant materials selected from the group consisting of compounds of the formula:



wherein x is 12, 14, 16, or 18, and n is 10, and mixtures thereof;

- B. ethoxylated nonionic surfactant materials selected from the group consisting of compounds of the formula:



wherein x is 12, 14, 16, or 18, and n is 20, and mixtures thereof;

and mixtures of A and B; wherein if A and B are both present they are at a ratio of A to B of from about 2:1 to about 1:2; and most preferably being a combination of Ceteth-10 and Ceteth-20 at a ratio of about 1:1; and

- f. from 30% to 50%, preferably 43% to 47%, of a monohydric alcohol solvent, said monohydric alcohol solvent preferably being ethanol;

wherein the antiperspirant composition comprises no more than 5%, preferably no more than 2.5%, water.

- 26 -

2. The composition of Claim 1 characterized in that from 2% to 5% of the volatile silicone emollient comprises a volatile dimethicone fluid having a viscosity of 0.65 centistokes.

3. The composition of any of the preceding claims characterized in that it additionally comprises from 5% to 8% of a co-solubilizer which is selected from the group consisting of propylene glycol (n) stearyl ether, where n is on the average from 10-16; and propylene glycol (n) myristyl ether where n is on the average from 2-10; and mixtures thereof, said co-solubilizer preferably being PPG-3 myristyl ether.

4. A method for preventing and controlling perspiration wetness in humans comprising application to the axillary area of an effective amount of an antiperspirant composition characterized in that said composition comprises the liquid antiperspirant solution according to any one of the preceding claims.

/jmc(KLS:CL4172)

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/02687

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
INT. CL. (5) A61K 7/38 U.S. CL. 424/68		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
U.S.	424/68	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	US, A, 4,732,754 (KREVALD) 22 MARCH 1988 Column 2, lines 25-34.	1-4
* Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
17 JULY 1991		07 AUG 1991
International Searching Authority		Signature of Authorized Officer
ISA/US		<i>DALE R. ORE</i> DALE R. ORE