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(54) Title: PRESSURIZED ANHYDROUS ANTIPERSPIRANT EMULSIONS

(57) Abstract: Disclosed are pressurized anhydrous antiperspirant emulsions, comprising a) an external, hydrophobic phase containing a liquefied propellant and a hydrophobic liquid other than and in addition to the liquefied propellant; and (b) an internal, polar phase containing antiperspirant active solubilized in a polar solvent. The anhydrous antiperspirant emulsions provide low residue or clear application to the underarm, and new formulation opportunities as compared to conventional pressurized antiperspirant compositions, including pressurized single-phase antiperspirant solutions as well as pressurized multi-phase antiperspirant suspensions containing dispersed solid antiperspirant active.

PRESSURIZED ANHYDROUS ANTIPERSPIRANT EMULSIONS

TECHNICAL FIELD

The present invention relates to pressurized anhydrous antiperspirant emulsions containing solubilized antiperspirant active.

BACKGROUND OF THE INVENTION

There are many different pressurized antiperspirant formulations known for use in controlling or inhibiting underarm perspiration and odor. Many of these formulations comprise an antiperspirant powder such as an aluminum salt, which is suspended in an anhydrous carrier and combined with a liquefied volatile propellant in a pressurized container. The formulation is then applied to the underarm as a pressurized spray that is generated by the rapid boiling of the propellant upon dispensing from an atomizing valve in association with the pressurized container. Although such products are the most commonly formulated antiperspirant products when a pressurized formulation is desired, they are limited by application characteristics such as a high visible residue on the skin during and after application, and a dusty or cloudy product stream during actuation and delivery of the pressurized system.

To avoid many of the above-described limitations commonly associated with conventional pressurized antiperspirant products, it is known that pressurized products can be formulated as single-phase solutions that contain solubilized antiperspirant active in a suitable aqueous or anhydrous carrier. These single-phase solutions, most of which contain high concentrations of water, ethanol or a dimethylether propellant, have the advantage over more conventional pressurized antiperspirant products in providing little or no visible residue on the skin. Moreover, these single-phase solutions often have a clear or translucent appearance, and unlike many pressurized products containing solid antiperspirant active, they can be applied neatly from an aerosolized spray without a dusty or powdery application stream. These single-phase systems, however, are often limited in formulation to those ingredients that can be solubilized or otherwise coupled into the selected single-phase matrix.

It has now been found that pressurized antiperspirant products can be formulated as anhydrous emulsions, wherein the emulsions provide the formulation flexibility of a conventional pressurized antiperspirant containing solid antiperspirant active, while also providing the low-

residue performance and application benefits associated with a single-phase pressurized antiperspirant product. It has been found that such a formulation can be realized, provided that it contains a) an external, hydrophobic phase containing a liquefied propellant and a hydrophobic liquid other than and in addition to the liquefied propellant; and (b) an internal, polar phase containing antiperspirant active solubilized in a polar solvent. The resulting anhydrous antiperspirant emulsions provide low residue or clear application to the underarm, and provide new formulation opportunities as compared to conventional pressurized antiperspirant compositions, including pressurized single-phase antiperspirant solutions as well as pressurized multi-phase antiperspirant suspensions containing solid antiperspirant active.

It is therefore an object of the present invention to provide a pressurized antiperspirant composition that is an alternative to more conventional pressurized antiperspirant products, including those that contain solid antiperspirant active and those that are in the form of a single-phase solution. It is a further object of the present invention to provide a pressurized composition that provides low residue performance, reduced dustiness or cloudiness during application, and new formulation opportunities as compared to more conventional pressurized antiperspirant products. It is a further object of the present invention to provide such a formulation in the form of a pressurized, anhydrous, emulsion antiperspirant.

SUMMARY OF THE INVENTION

The present invention is directed to pressurized anhydrous antiperspirant emulsions, comprising (a) an external, hydrophobic phase containing a liquefied propellant and a hydrophobic liquid other than and in addition to the liquefied propellant and (b) an internal, polar phase containing antiperspirant active solubilized in a polar solvent. The anhydrous antiperspirant emulsions provide low residue or clear application to the underarm, and new formulation opportunities as compared to conventional pressurized antiperspirant compositions, including pressurized single-phase antiperspirant solutions as well as pressurized multi-phase antiperspirant suspensions containing solid antiperspirant active.

DETAILED DESCRIPTION OF THE INVENTION

The pressurized antiperspirant compositions of the present invention comprise a an external, hydrophobic phase containing a liquefied propellant and a hydrophobic liquid, and an internal polar-phase containing antiperspirant active solubilized in a polar solvent. These and other essential elements or limitations of the pressurized antiperspirant compositions of the present invention are described in detail hereinafter.

The term "anhydrous" as used herein, unless otherwise specified, refers to those compositions or materials containing less than about 15%, more preferably less than about 5%, even more preferably less than about 1%, even more preferably zero percent, by weight of water.

The term "ambient conditions" as used herein, unless otherwise specified, refers to surrounding conditions at about one atmosphere of pressure, at about 50% relative humidity, and at about 25°C.

The term "non-volatile" as used herein, unless otherwise specified, refers to those materials having no significant or measurable vapor pressure as measured at 25°C, which typically includes those materials having a vapor pressure less than about 0.01 mmHg. Such non-volatile materials will generally have a viscosity as measured under ambient conditions of at least about 10 centistokes. The term "volatile" as used herein, unless otherwise specified, therefore refers to all other materials that do not satisfy the above-described characteristics of a non-volatile material.

The term "pressurized antiperspirant" as used herein, unless otherwise specified, means any packaged antiperspirant composition that is pressurized from a gas or liquefied gas propellant to thus provide a means for pushing or moving the antiperspirant composition through an application device.

All percentages, parts and ratios as used herein, unless otherwise specified, are by weight of the total composition. All such weights as they pertain to listed ingredients are based on the active level and, therefore, do not include solvents or by-products that may be included in commercially available materials, unless otherwise specified.

The pressurized antiperspirant compositions of the present invention can comprise, consist of, or consist essentially of the essential elements and limitations of the invention described herein, as well as any additional or optional ingredients, components, or limitations described herein or otherwise useful in pressurized antiperspirant applications.

Product Form

The pressurized antiperspirant compositions of the present invention are in the form of multi-phase emulsions, typically a two-phase emulsion, wherein the emulsion has an internal, discontinuous, polar-phase containing antiperspirant active solubilized in a polar solvent, and a continuous, hydrophobic, external-phase containing a liquefied propellant and a hydrophobic liquid other than and in addition to the liquefied propellant.

The pressurized emulsions of the present invention are anhydrous liquids, so that the internal and external phases of the pressurized emulsions are also anhydrous, but may contain

small amounts of water associated with the antiperspirant active during formulation. These pressurized emulsions are contained within a suitable pressurized container.

The distinct phases of the pressurized emulsions are formulated so that the internal phase comprises antiperspirant active solubilized in a suitable anhydrous polar solvent, the polar solvent and the antiperspirant active being described in greater detail hereinafter. These pressurized emulsions are also formulated so that the continuous external-phase of the emulsion comprises a liquefied propellant, most typically a hydrocarbon propellant, all within a hydrophobic matrix. The liquefied propellant and other suitable hydrophobic materials for use in the external-phase of the pressurized emulsion are described in greater detail hereinafter.

The internal and external phases of the pressurized emulsions may comprise any of a variety of materials, so long as such materials are compatible with the emulsion phase in which that optional material is formulated. For example, the internal phase may comprise any of a variety of relatively polar materials such as monohydric alcohols or other materials having relatively polar functional groups, whereas the external hydrophobic phase may further comprise any of a variety of relatively hydrophobic materials suitable for use in personal care products such as silicone or non-silicone containing emollients, emulsifying agents, carrier liquids, and so forth.

The pressurized antiperspirant emulsion may be packaged in conventional pressurized containers for use in contact or non-contact product forms. Non-contact products from pressurized containers are well known in the antiperspirant and personal care arts, non limiting examples of which are described in U.S. Patents 3,082,917; U.S. Patent 3,083,918; and U.S. Patent 3,544,258, which descriptions are incorporated herein by reference. Pressurized contact antiperspirants are likewise known in the antiperspirant art, non limiting examples of which are described in U.S. Patent 5,567,073 (de Laforcade et al.), which description is incorporated herein by reference.

The terms "contact" and "contact product form" refer to any known or otherwise suitable pressurized package that comprises an applicator surface to which the antiperspirant composition is delivered under pressure from within the pressurized package, and from which the antiperspirant composition is then applied directly to the underarm area of the skin. In this context, the applicator surface directly contacts the underarm during application, thus delivering or depositing the pressurized antiperspirant composition to the underarm area of the skin.

The term "non-contact" or "non-contact product form" as used herein refers to pressurized packages from which the antiperspirant composition is delivered to the underarm through a product stream delivered under pressure from within the package to the skin. In this context, there is no direct contact between any surface of the pressurized package and the underarm.

Solubilized Antiperspirant Active

The pressurized antiperspirant compositions of the present invention comprise an internal phase containing a solubilized antiperspirant active suitable for application to human skin. The concentration of antiperspirant active in the composition should be sufficient to provide the finished antiperspirant product with the desired perspiration wetness and odor control. The antiperspirant active may be solubilized by any polar solvent that is suitable for application to the skin and that is otherwise compatible with the selected ingredients in the anhydrous emulsion.

Solubilized antiperspirant active concentrations in the pressurized antiperspirant emulsions preferably range from about 0.1% to about 26%, more preferably from about 1% to about 20%, even more preferably from about 2% to about 10%, by weight of the composition. All such weight percentages are calculated on an anhydrous metal salt basis exclusive of water and any complexing or buffering agent such as glycine, glycine salts, or other complexing or buffering agent.

The solubilized antiperspirant active for use in the pressurized antiperspirant emulsions of the present invention include any compound, composition or other material having antiperspirant activity. Preferred antiperspirant actives include astringent metallic salts, especially the inorganic and organic salts of aluminum, zirconium and zinc, as well as mixtures thereof. Particularly preferred are salts such as aluminum halides, aluminum chlorohydrate, aluminum hydroxyhalides, zirconyl oxyhalides, zirconyl hydroxyhalides, and mixtures thereof. Aluminum salts are most preferred for non-contact pressurized compositions.

Preferred aluminum salts for use in the pressurized antiperspirant emulsions include those that conform to the formula:

$$Al_2(OH)_a\,Cl_b \cdot x\,H_2O$$

wherein a is from about 2 to about 5; the sum of a and b is about 6; x is from about 1 to about 6; and wherein a, b, and x may have non-integer values. Particularly preferred are the aluminum chlorhydroxides referred to as "5/6 basic chlorhydroxide", wherein a = 5, and "2/3 basic chlorhydroxide" wherein a = 4. Processes for preparing aluminum salts are disclosed in U.S. Patent 3,887,692, Gilman, issued June 3, 1975; U.S. Patent 3,904,741, Jones et al., issued September 9, 1975; U.S. Patent 4,359,456, and Gosling et al., issued November 16, 1982, all of which are incorporated herein by reference. Mixtures of aluminum salts are described in British Patent Specification 1,347,950, Shin et al., published February 27, 1974.

Zirconium salts for use in the pressurized antiperspirant emulsions, especially in pressurized contact forms, include those that conform to the formula:

$$ZrO(OH)_{2-a}Cl_a \cdot x\,H_20$$

wherein a is any number having a value of from 0 to about 2; x is from about 1 to about 7; and wherein a and x may both have non-integer values. Preferred zirconium salts are those complexes which additionally contain aluminum and glycine, commonly known as ZAG complexes. These ZAG complexes contain aluminum chlorhydroxide and zirconyl hydroxy chloride conforming to the above described formulas. Such ZAG complexes are described in U.S. Patent 3,679,068, Luedders et al., issued February 12, 1974; Great Britain Patent Application 2,144,992, Callaghan et al., published March 20, 1985; and U.S. Patent 4,120,948, Shelton, issued October 17, 1978.

Preferred antiperspirant actives for use in the pressurized antiperspirant emulsions include aluminum chlorohydrate, aluminum dichlorohydrate, aluminum sesquichlorohydrate, aluminum chlorohydrex propylene glycol complex, aluminum dichlorohydrex propylene glycol complex, aluminum sesquichlorohydrex propylene glycol complex, aluminum chlorohydrex polyethylene glycol complex, aluminum dichlorohydrex polyethylene glycol complex, aluminum sesquichlorohydrex polyethylene glycol complex, aluminum sulfate buffered, and combinations thereof.

Non limiting examples of solubilized antiperspirant active for use in the pressurized antiperspirant emulsions of the present invention, and methods of making the solubilized active, are described in U.S. Patent 6,149,897 (Swaile); U.S. Patent 6,126,928 (Swaile); and U.S. Patent 5,968,489 (Swaile et al.), which descriptions are incorporated herein by reference. Other non limiting examples of solubilized antiperspirant active and methods of making it are described in EP 0 404 533 (Smith et al.).

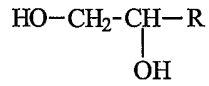
Polar Solvent

The pressurized antiperspirant emulsion of the present invention comprises a polar solvent for solubilizing or helping to solubilize the antiperspirant active material within the internal-phase of the pressurized antiperspirant emulsion. The concentration of the polar solvent is preferably about 1% to about 50%, more preferably from about 10% to about 40%, by weight of the emulsion.

The term "polar solvent" as used herein, unless otherwise specified, refers to any liquid that can solubilize or help to solubilize the antiperspirant active within the internal liquid phase of the pressurized antiperspirant emulsion, or that is otherwise soluble or miscible in the internal phase of the antiperspirant emulsion wherein the internal phase contains solubilized antiperspirant active. The polar solvent will generally have a solubility parameter of greater than about 10 cal/cm^3 while the hydrophobic liquid as described herein will generally have a solubility parameter of less than about 10 cal/cm^3, although it is possible for purposes of the present

invention to have a polar solvent with a solubility parameter of less than about 10 cal/cm^3 and a hydrophic liquid with a solubility parameter of greater than about 10 cal/cm^3. It is also possible for purposes of the present invention for a solvent in one embodiment to be a polar solvent that partitions into the internal polar phase, and for other embodiments the same liquid could then be part of and partition into the external hydrophobic phase. Solubility parameters and means for determining them are well known in the chemical arts, examples of which are described by C.D. Vaughan, "Solubility Effects in Product, Package, Penetration and Preservation" 103 Cosmetics and Toiletries, 47-49, October 1988: and C.D. Vaughan, "Using Solubility Parameters in Cosmetics Formulations", 36 J. Soc. Cosmetic Chemists 319-333, September/October, 1988.

The polar solvent for use in the pressurized antiperspirant emulsions of the present invention is preferably a liquid polyol having two or more hydroxyl groups, preferably a polyol having at least 3 carbon atoms and adjacent hydroxy-substituted carbon atoms at the α and β positions of the liquid polyol. Preferred liquid polyols for use in the compositions are those that conform to the formula:



wherein R is an amide, ester, alkyl, ether or silicone-containing moiety, each moiety containing at least 1 carbon atom. The R group is preferably an alkyl or ether group, more preferably an alkyl group having from about 2 to about 10 carbon atoms, more preferably from about 3 to about 5 carbon atoms. The liquid polyols preferably have either 2 or 3 hydroxyl groups in total.

The R group on the liquid polyol can be substituted or unsubstituted, branched or straight or cyclic, saturated or unsaturated. Non limiting examples of suitable substituents include hydroxyl groups, amines, amides, esters, ethers, alkoxylate groups (e.g., ethoxylates, propoxylates, etc.) and so forth.

Non limiting examples of suitable polar solvent for use in the pressurized emulsions of the present invention include 1,2-butanediol; 1,2-pentanediol; 4-methyl-1,2-pentanediol; 2-methyl-1,2-pentanediol; 3,3-methyl-1,2-butanediol; 4-methyl-1,2-hexanediol; 1,2-heptanediol; 3-phenyl-1,2-propanediol; 1,2,6-hexanetriol; 1,2-hexandiol; 1,2,4-butanetriol; propylene glycol; glycerin; sorbitol; and combinations thereof. Other suitable liquid polyols include glycerol ethers such as glycerol isopropyl ether; glycerol propyl ether; glycerol ethyl ether; glycerol methyl ether; glycerol butyl ether; glycerol isopentyl ether; diglycerol isopropyl ether; diglycerol isobutyl ether; diglycerol; triglycerol; triglycerol ; isopropyl ether; and combinations thereof.

Still other suitable polar solvents include acetic acid glycerol ester; propanoic acid glycerol ester; butanoic acid glycerol ester; 3-methyl butanoic acid glycerol ester; and 3-trimethylsily-1,2-

propane diol; silicone-containing 1, 2-diols such as those described in U.S. Patent 5,969,172 (Nye); and combinations thereof.

Especially preferred are those embodiments having a polar solvent that contains glycerin in combination with at least one other polar solvent, preferably glycerin in combination with a 1,2-polyol solvent as described herein.

These polar solvents may be used in combination with one or more other anhydrous liquid carrier, examples of such other anhydrous liquid carriers include any known or otherwise effective carrier liquids suitable for topical application to the skin, and that are compatible with selected pressurized emulsion formulation. It should be noted, however, that as such optional carriers become more hydrobobic and less polar, that such materials will instead be formulated into or otherwise settle within the external hydrophobic phase of the pressurized emulsion.

The polar solvent may comprise ethanol or other similar polar solvents, but only to the extent that such solvents can be formulated into the composition without unduly affecting the stability of the selected emulsion system. The pressurized emulsion, and therefore the polar solvent in the pressurized emulsion, are preferably substantially free of ethanol. In this context, the term "substantially free" means that the pressurized emulsion preferably contains less than 20%, more preferably less than 10%, even more preferably less than 3%, most preferably zero percent, of ethanol by weight of the pressurized emulsion composition.

Propellant

The pressurized antiperspirant emulsion of the present invention comprises a continuous, hydrophobic, external phase that contains a liquefied propellant in combination with a hydrophobic liquid other than and in addition to the liquefied propellant. The liquefied propellant can be any propellant that is compatible with the essential ingredients in the selected formulation and which can be solubilized into the external hydrophobic phase of the pressurized emulsion. The propellant concentration in the emulsion ranges from about 5% to about 99%, more typically from about 15% to about 90%, even more preferably from about 30% to about 70%, by weight of the pressurized emulsion composition.

The liquefied propellant is typically a liquefied gas such as nitrous oxide, volatile hydrocarbons, carbon dioxide, and halogenated hydrocarbons such as trichlorofluoromethane, diclorodifluoromethane, diclorotetrafluoroethane trichlorotrifluoroethane, difluoroethane, trichlorotetrafluoroethane, and monochlorodifluoromethane, and combinations thereof.

Preferred liquefied propellants for use in the pressurized emulsion include any hydrocarbon propellant known for or otherwise suitable for application to human skin, non limiting examples of which include propane, butane, pentane, isobutane, and combinations

thereof. These hydrocarbon propellants are hydrophobic and generally in the form of a liquefied gas when formulated into the antiperspirant compositions. The hydrophobic character of these propellants has these materials formulated within or otherwise petitioning into the external hydrophobic phase of the pressurized emulsion composition.

Hydrophobic Liquid

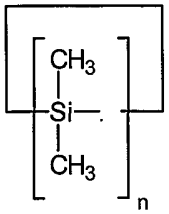
The external hydrophobic phase of the pressurized antiperspirant emulsions of the present invention comprise a hydrophobic or low polarity liquid in combination with the essential liquefied propellant component as described herein. The hydrophobic liquid can be any low-polarity liquid suitable for application to the skin that is soluble in or miscible with the external hydrophobic phase, or which otherwise does not partition into the internal polar phase as described herein.

The terms "hydrophobic" and "low-polarity" are used interchangeably herein and refer to those materials that are insoluble in and therefore maintained or partitioned outside of the internal polar-phase of the pressurized antiperspirant emulsion described herein.

The hydrophobic liquids for use in the pressurized antiperspirant emulsions include any silicone-containing or non-silicone containing material that is suitable for topical application to the skin, and that is soluble in or miscible with the external hydrophobic phase of the pressurized antiperspirant emulsions herein. These hydrophobic materials can therefore be volatile or non volatile, cyclic or linear or branched chain, substituted or unsubstituted, silicone or non-silicone containing, provided that they have the requisite hydrophobicity.

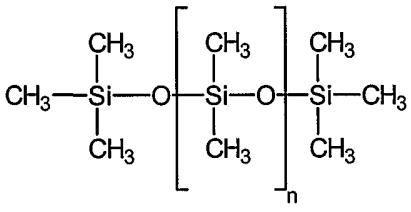
Preferred hydrophobic liquids for use in the pressurized antiperspirant emulsions are silicone containing liquids, preferred concentrations of which range from about 0.1% to about 75%, more preferably from about 1% to about 50%, more preferably from about 2% to about 30%, by weight of the pressurized emulsion composition.

Non limiting examples of suitable volatile silicones for use as hydrophobic liquids herein, are described in Todd et al., "Volatile Silicone Fluids for Cosmetics", Cosmetics and Toiletries, 91:27-32 (1976), which descriptions are incorporated herein by reference. Preferred among these volatile silicones are the cyclic silicones having from about 3 to about 7, more preferably from about 4 to about 5, silicon atoms. Most preferably are those that conform to the formula:

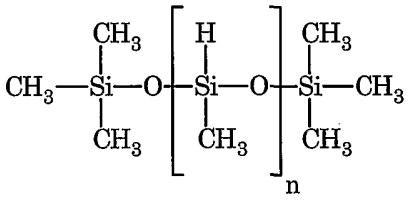


wherein n is from about 3 to about 7, preferably from about 4 to about 5, most preferably 5 (cyclopentasiloxane). These volatile cyclic silicones generally have a viscosity value of less than about 10 centistokes as measured at 25°C. Suitable volatile silicones for use herein include, but are not limited to, Cyclomethicone D-5 (commercially available from G. E. Silicones); DC 1184, DC 344, DC 1731, and DC 345 (commercially available from Dow Corning Corp.); GE 7207, GE 7158 and Silicone Fluids SF-1202 and SF-1173 (available from General Electric Co.); SWS-03314, SWS-03400, F-222, F-223, F-250, F-251 (available from SWS Silicones Corp.); Volatile Silicones 7158, 7207, 7349 (available from Union Carbide); Masil SF-V (available from Mazer) and combinations thereof. Cyclopentasiloxane is most preferred among the volatile silicone liquids.

Non limiting examples of non volatile silicone liquids for use as hydrophobic liquids in the pressurized antiperspirant emulsions of the present invention include those that conform to either of the formulas:



or



wherein n is greater than or equal to 1. These linear silicone materials will generally have viscosity values of from about 10 centistoke to about 100,000 centistoke, preferably less than about 500 centistoke, more preferably from about 20 centistoke to about 200 centistoke, even more preferably from about 20 centistoke to about 50 centistoke, as measured under ambient conditions. Non limiting examples of non-volatile, linear silicones suitable for use in the antiperspirant compositions include but are not limited to, Dow Corning 200, hexamethyldisiloxane, Rhodorsil Oils 70047 available from Rhone-Poulenc, Masil SF Fluid available from Mazer, Dow Corning 225, Dow Corning 1732, Dow Corning 5732, Dow Corning 5750 (available from Dow Corning Corp.); SF-96, SF-1066 and SF18(350) Silicone Fluids (available from G.E. Silicones); Velvasil and Viscasil (available from General Electric Co.); and Silicone L-45, Silicone L530, Silicone L-531 (available from Union Carbide), and Siloxane F-221 and Silicone Fluid SWS-101 (available from SWS Silicones).

Other hydrophobic liquids suitable for use herein include modified or organofunctional silicone carriers such as polyalkylsiloxanes, polyalkyarylsiloxanes, cross-linked silicone elastomers, polyestersiloxanes, polyethersiloxane copolymers, polyfluorosiloxanes, polyaminosiloxanes, and combinations thereof. These modified silicone carriers are typically liquid under ambient conditions, and have a preferred viscosity of less than about 100,000

centistokes, more preferably less than about 500 centistokes, even more preferably from about 1 centistoke to about 50 centistokes, and most more preferably from about 1 centistoke to about 20 centistokes. These modified silicone carriers are generally known in the chemical arts, some examples of which are described in 1 *Cosmetics, Science and Technology* 27-104 (M. Balsam and E. Sagarin ed. 1972); U.S. Patent 4,202,879, issued to Shelton on May 13, 1980; U.S. Patent 5,069,897, issued to Orr on December 3, 1991; which descriptions are incorporated herein by reference.

Other hydrophobic liquids suitable for use herein include hydrocarbons materials, non limiting examples of which include mineral oil, polyisobutene, and mixtures thereof.

The pressurized antiperspirant emulsions of the present invention may further comprise many other hydrophobic materials for incorporation into the hydrophobic external phase, provided that such other materials are compatible with the other ingredients in the composition and do not unduly impact the stability of the selected emulsion system.

Emulsifying Agent

The pressurized antiperspirant emulsions of the present invention preferably further comprise an emulsifying agent to provide enhanced emulsion stability. The emulsifying agent includes any surfactant that is known for or otherwise compatible with aluminum-containing antiperspirant actives and any other ingredients in the selected formulation. The emulsifying agent may be solubilized in either of the internal and/or external phase, or in any other intermediate phase, but is preferably solubilized or dispersed primarily in the external hydrophobic phase.

Non-limiting examples of suitable emulsifying agents include cationic surfactants, nonionic surfactants, or any other ampholytic surfactant that at the formulation or use pH does not contain a charged cationic species. Preferred emulsifying agents include silicone polyethers such as dimethicone copolyols. These preferred dimethicone copolyols are dimethicone chains with pendant or terminal polyether chains comprising ethylene oxide and propylene oxide, specific examples of which include those copolyols from Dow Corning (DC 5225, DC 3225, DC5202, DC5200); General Electric (SF1528); and Witco (Silwet L7622).

Still other suitable emulsifying agents include polysorbitans, fatty acid esters, sorbitan esters, polyglycerol esters, PEG esters, PPG esters, and combinations thereof.

Optional Ingredients

The pressurized antiperspirant emulsions of the present invention may further comprise other optional ingredients to modify the physical, chemical, cosmetic or aesthetic characteristics

of the compositions or serve as additional "active" components when deposited on the skin. The compositions may also further comprise optional inert ingredients. Many such optional ingredients are known for use in deodorants, antiperspirants or other personal care compositions, and may also be used in the antiperspirant compositions herein, provided that such optional materials are compatible with the essential materials described herein, or do not otherwise unduly impair product performance or emulsion stability.

Non limiting examples of optional ingredients include preservatives, deodorant antimicrobials, fragrances, deodorant perfumes, coloring agents or dyes, thickeners, pH modifiers, pharmaceutical actives, vitamins, and combinations thereof.

Optional ingredients can be in the form of solids or liquids, although the pressurized antiperspirant compositions of the present invention are preferably substantially free of solid materials. In this context, the term "substantially free" means that the compositions may contain such materials but preferably contain less than 5%, more preferably less than 2%, most preferably zero percent, by weight of such solid materials in the compositions.

Method of Use

The pressurized antiperspirant emulsions of the present invention may be applied topically to the axilla or other area of the skin in an amount effective to treat or reduce perspiration wetness and/or malodor. The composition is preferably applied in an amount ranging from about 0.1 gram to about 20 grams, more preferably from about 0.1 gram to about 10 grams, even more preferably from about 0.1 gram to about 1 gram, to the desired area of the skin. The compositions are preferably applied to the axilla or other area of the skin, one or two times daily, preferably once daily, to achieve effective antiperspirant and/or malodor control over an extended period. The emulsions applied by such methods may be dispensed from a contact or non-contact pressurized package.

Method of Manufacture

The pressurized antiperspirant emulsions of the present invention may be prepared by any known or otherwise effective technique, suitable for making and formulating a two-phase or other multi-phase emulsion containing an internal polar phase and an external hydrophobic phase.

These pressurized compositions are generally prepared by formulating an anhydrous emulsion from all of the product ingredients other than the liquefied propellant, and then

combining the anhydrous emulsion with the liquefied propellant in a pressurized container to form a pressurized anhydrous emulsion.

More specifically, the hydrophobic external phase is prepared which should include all hydrophobic materials (other than the propellant) and any emulsifying agent that is soluble in or otherwise inherently partitions into the hydrophobic. The polar internal phase is then prepared, most typically as a solution, in a separate vessel which should includes all polar materials such as antiperspirant active and any emulsifying agent that is soluble in or otherwise inherently partitions into the polar phase. The polar phase is then added slowly to the external phase under shear to create a uniform emulsified particle size. The resulting anhydrous emulsion is then placed in a pressurized package, the package sealed, any entrapped air removed from the package, and then the liquefied propellant added to the pressurized package composition to form a pressurized antiperspirant emulsion.

Preferred compositions and methods of manufacture are described hereinafter in the following exemplified embodiments of the pressurized antiperspirant emulsions of the present invention.

EXAMPLES

The following examples further describe and demonstrate specific embodiments within the scope of the present invention. The examples are given solely for the purpose of illustration and are not to be construed as limitations of the present invention, as many variations thereof are possible without departing from the spirit and scope of the invention. All exemplified amounts are concentrations by weight of the total composition, unless otherwise specified.

The compositions described below in Examples A-G are pressurized antiperspirant emulsions containing an internal polar-phase containing solubilized antiperspirant active and a polar solvent, and an external hydrophobic phase containing a liquefied hydrocarbon propellant and a suitable hydrophobic carrier liquid. Each of the compositions is packaged in a pressurized contact container, as well as a non-contact pressurized spray container. The products are applied to the underarm area of the skin to provide antiperspirant and deodorant efficacy. The products result in little or no visible residue during and after application to the underarm

Each of the compositions described below (Examples A-G) is prepared by mixing together under shear all of the external phase materials other than the liquefied propellant, and then mixing together in a separate container all of the internal phase materials until a clear solution forms. The internal phase materials are then added slowly to the external phase materials under sufficient shear to create uniform emulsified particle size. The resulting anhydrous

emulsion is then placed in a clear package and then sealed with a delivery valve and evacuated to between 14 and 25 inches of mercury. The liquefied propellant is then added to the clear package under appropriate pressure using a burette filler. The resulting packaged composition is then heated in a water bath (150°F) for 5 minutes to assure proper sealing of the valve.

Table 1: Anhydrous Pressurized Antiperspirant Emulsions

Ingredient	A	B	C	D	E	F	G
INTERNAL PHASE							
Aluminum chlorohydrate 20% solution in propylene glycol							20
Aluminum chlorohydrate 20% solution in glycerin					5	2.5	
Aluminum chlorohydrate 20% solution in 1,2-hexanediol					5		
Aluminum chlorohydrate 25% solution in 1,2-pentanediol						2.5	
Aluminum zirconium trichlorohydrate glycine 25% solution in propylene glycol		25	65				
Aluminum zirconium trichlorohydrate glycine 25% solution in glycerin				55			
Aluminum zirconium trichlorohydrate glycine 25% solution in 1,2-hexanediol	40	10		10			
Ethanol	10	10	5	5	3	1.25	5
Propylene glycol			10				
Butylene glycol				10			
Polysorbate 20						0.05	
EXTERNAL PHASE							
Dimethicone copolyols and Cyclopentasiloxane	10	10	10	10	1	1	4
Dimethicone 10cst					5	3.75	
Dimethicone 50 cst	15						5
Cyclopentasiloxane	10	35			3	2.95	20
Hexamethyl disiloxane							10
Liquified Propellants:							
Butane	15				78	86	16
Propane		10					
Isobutane			10	10			
1,1-difluoroethane							20

WHAT IS CLAIMED IS:

1. Pressurized anhydrous antiperspirant emulsions characterized by:

(a) an external, hydrophobic phase containing a liquefied propellant and a hydrophobic liquid other than and in addition to the liquefied propellant; and

(b) an internal, polar phase containing an antiperspirant active solubilized in a polar solvent;

wherein the pressurized composition is anhydrous and is packaged within a pressurized container.

2. The composition of Claim 1 wherein the external phase represents from 50% to 99% by weight of the composition and the internal phase represents from 1% to 50% by weight of the composition.

3. The composition of Claim 1 wherein the antiperspirant active is an aluminium-containing antiperspirant active.

4. The composition of Claim 1, wherein the internal polar phase is further characterized as a liquid polyol selected from the group consisting of 1,2-butanediol; 1,2-pentanediol; 4-methyl-1,2-pentanediol; 2-methyl-1,2-pentanediol; 3,3-methyl-1,2-butanediol; 4-methyl-1,2-hexanediol; 1,2-heptanediol; 3-phenyl-1,2-propanediol; 1,2,6-hexanetriol; 1,2-hexandiol; 1,2,4-butanetriol; glycerol isopropyl ether; glycerol propyl ether; glycerol ethyl ether; glycerol methyl ether; sorbitol; glycerol butyl ether; glycerol isopentyl ether; diglycerol isopropyl ether; diglycerol isobutyl ether; diglycerol; triglycerol; triglycerol isopropyl ether; acetic acid glycerol ester; propanoic acid glycerol ester; butanoic acid glycerol ester; 3-methyl butanoic acid glycerol ester; and 3-trimethylsily-1,2-propane diol; and combinations thereof.

5. The composition of Claim 1, wherein the hydrophobic liquid in the external phase is characterized as having a silicone-containing liquid at a concentration of from 0.1% to 75% by weight of the composition.

6. The composition of Claim 7 wherein the silicone-containing liquid is characterized as cyclopentasiloxane.

7. The composition of Claim 1 wherein the external phase is further characterized as an emulsifying agent.

8. The composition of Claim 1 wherein the composition is visibly clear or translucent.

9. The composition of Claim 1 wherein the liquefied propellant is characterized as having a hydrocarbon propellant selected from the group consisting of propane, pentane, butane, isobutane, isopentane, or combinations thereof.

10. The composition of Claim 17 wherein the hydrophobic liquid is characterized as having a hydrophobic silicone-containing fluid.

INTERNATIONAL SEARCH REPORT

Ir ational Application No
PCT/US 02/19508

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K7/32

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61K

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, CHEM ABS Data, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01 13869 A (PROCTER & GAMBLE) 1 March 2001 (2001-03-01) example 7 ---	1-10
A	US 5 993 837 A (SANDEWICZ ROBERT WALTER ET AL) 30 November 1999 (1999-11-30) column 7, line 11 - line 14 ---	1-10
A	US 6 153 205 A (PHAM DANG-MAN ET AL) 28 November 2000 (2000-11-28) example 6 ---	1-10
X	WO 01 13867 A (PROCTER & GAMBLE) 1 March 2001 (2001-03-01) example 11 --- -/--	1-10

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

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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 when the document is taken alone

"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

Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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