Title: COSMETIC USE AS DEODORANT ACTIVE AGENT OF PARTICLES OF HYDROPHOBIC SILICA

Abstract: The present invention relates to the cosmetic use, as a deodorant active agent, of hydrophobic silica particles which may be obtained by reaction: i) of at least one porous precipitated amorphous silica bearing surface hydroxyl groups with an alkyl-trialkoxysilane of formula (I) below: R₃Si(OR)₃, (I) in which R₁ denotes a C₃ to C₈ alkyl group, optionally interrupted in its chain with an O or S atom or with an NH group or a carbonyl group (CO), R₂ denotes a C₁-C₈ alkyl group and ii) optionally at least one aminosilyltrialkoxysilane of formula (II) below: R₂Si(OR)₃, (II) in which R₁ denotes a C₁-C₈ alkyl group, R₄ denotes a linear or branched, saturated or unsaturated C₃-C₈ or cyclic C₃-C₆ hydrocarbon-based group, or denotes a C₃-C₈ aryl or C₃-C₆ arylxy group substituted with an amino group NH₂ or NHR with R denoting a C₁-C₈ alkyl radical, in an inert solvent, at a temperature ranging from 30°C to 200°C. The invention also relates to a cosmetic process for treating human body odour, in particular underarm odour and optionally human perspiration, which consists in applying to human keratin materials the said hydrophobic silica particles or a composition containing the same in a cosmetically acceptable medium.
COSMETIC USE AS DEODORANT ACTIVE AGENT OF PARTICLES OF HYDROPHOBIC SILICA

The present invention relates to the cosmetic use as a deodorant active agent of particles of hydrophobic silica which has been modified by at least one C₈-C₂₀-alkyl trialkoxysilane and optionally an aminoalkyl trialkoxysilane and, more particularly, the said particles are present in a composition comprising a cosmetically acceptable medium.

The invention also relates to a cosmetic process for treating human body odour, in particular underarm odour and optionally human perspiration, which consists in applying to human keratin materials the said hydrophobic silica particles or a composition containing the same in a cosmetically acceptable medium.

The invention also relates to a composition characterized in that it comprises, in a cosmetically acceptable medium, at least the said particles of hydrophobic modified silica and at least one deodorant agent other than the said particles and/or at least one antiperspirant active agent.

Eccrine or apocrine sweat has little odour when it is secreted. It is its degradation by bacteria via enzymatic reactions which produces malodorous compounds. The compounds which contribute to unpleasant underarm odour comprise malodorous steroids, volatile fatty acids, especially aliphatic, branched, saturated and/or unsaturated (C₂-C₁₂) fatty acids, and sulfanylalkanol compounds (Chem. Biodivers., 1, 1058-1072, (2004)). Certain precursors of odorous substances and mechanisms for generating them are described in the scientific literature [see, for example, Journal of Investigative Dermatology, 130, 529-540, (2010); Int. J. Cosmet. Sci., 26, 149-156, (2004)].

The function of deodorant active agents is to reduce or prevent the formation of unpleasant odours. The various systems proposed hitherto may be grouped mainly into four large families i) to iv).

i) Bactericidal substances or substances which limit the growth of bacteria. Bactericides destroy the resident bacterial flora. The most widely used bactericides are triclosan (2,4,4'-trichloro-2'-hydroxydiphenyl ether), chlorhexidine (1,6-bis(4-chlorophenyl)biguanidino)hexane) and TTC (3,4,4'-trichlorocarbanilide). Among the substances which reduce the growth of bacteria, mention may be made of transition-metal-chelating agents such as ethylenediaminetetraacetic acid (EDTA) or diethylenetriaminepentaacetic acid (DTPA);

ii) Substances which block the enzymatic reactions responsible for the formation of the odorous compounds. Mention may be made of arylsulfatase, 5-lipoxygenase, aminocyclase and β-glucuronidase inhibitors;

iii) Unpleasant odour absorbers which “capture” or reduce the volatility of odorous compounds. Odour absorbers that may be mentioned include zeolites
and cyclodextrins. It is also known that certain types of solid particles may be used as deodorants, such as the metal oxide silicates of patent application US 2005/063 928, the metal oxide particles modified with a transition metal in patent applications US 2005/084 464 and US 2005/084 474, aluminosilicates such as those described in patent application EP 1 658 863, and nanometric chitosan-based particles such as those described in patent US 6 916 465; and

iv) Antiperspirants, including aluminium and/or zirconium salts, which are the most commonly used as active agents. These aluminium salts also have intrinsic efficacy since they are antibacterial agents. They thus also play a direct role on the deodorant efficacy by reducing the number of bacteria responsible for the degradation of sweat.

Deodorant products are described in several books. An example that may be mentioned is Ullmann’s Encyclopedia of Industrial Chemistry, "Skin Cosmetics", G. Schneider et al., http://onlinelibrary.wiley.com/doi/10.1002/14356007.a24_219/pdf, published online on 15/01/2001, Wiley-VCH, DOI: 10.1002/14356007.a24_219, point 8 "Deodorants and Antiperspirants" (2012).

It is also known that certain types of solid particle may be used as deodorants, such as the metal oxide silicates of patent application US 2005/063 928; metal oxide particles modified with a transition metal in patents US 2005/084 464 and US 2005/084 474, aluminosilicates such as those described in patent application EP 1 658 863, and nanometric chitosan-based particles such as those described in patent US 6 916 465.

It has already been proposed in patent application US 2004/0 001 897 to use in deodorant compositions fumed silica particles of colloidal structure modified with dimethylsilyl or trimethylsilyl groups, such as the product sold under the trade name Aerosil R972®.

It has also been proposed in patent application US 4 605 554 to use in deodorant or antiperspirant compositions silicas hydrophobic-modified with organosilylamine groups such as (CH₃O)₅Si(CH₃)₃NH(CH₂)₃NH₂ and (CH₃O)₅Si(CH₃)₂Si(CH₂)CH(CH₃)₃-NHCH₂CH₂-NH₂, organodisilazane groups such as (CH₃)₃SiNHSi(CH₃)₃ and (C₆H₅)₃SiNHSi(C₆H₅)₃, for instance the hydrophobic fumed silicas sold under the trade names Aerosil R972® and Tullanos 500®.

Particles of colloidal silica modified with a transition metal and an aminosilane are also known from patent US 7 438 875, for instance 3-aminopropyltriethoxysilane (APTES), which have been used as deodorant active agent.

These prior art compositions based on hydrophobic-modified silica are not, however, entirely satisfactory in terms of deodorant efficacy.

There is thus still a real need to make novel cosmetic deodorant active agents in the form of particles of hydrophobic modified silica which have better efficacy than those mentioned previously.
The Applicant has discovered, surprisingly, that this objective can be achieved with novel particles of hydrophobic silica which has been modified by at least one C₈-C₂₀-alkyltrialkoxy silane of formula (I) which will be defined in detail later and optionally by at least one aminoalkyl trialkoxysilane of formula (II) which will be defined in detail later.

This discovery forms the basis of the present invention.

The invention thus relates to the cosmetic use of particles of hydrophobic silica which has been modified by at least one C₇-C₂₀-alkyl trialkoxysilane of formula (I) which will be defined in detail later and optionally by at least one aminoalkyltrialkoxy silane of formula (II) which will be defined in detail later, as a deodorant active agent and, more particularly, the said particles are present in a composition comprising a cosmetically acceptable medium.

The invention also relates to a cosmetic process for treating human body odour, in particular underarm odour and optionally human perspiration, which consists in applying to human keratin materials the said hydrophobic silica particles or a composition containing the same in a cosmetically acceptable medium.

The invention also relates to a composition characterized in that it comprises, in a cosmetically acceptable medium, at least the said particles of hydrophobic modified silica and at least one deodorant agent other than the said particles and/or at least one antiperspirant active agent.

For the purposes of the present invention, the term "physiologically acceptable medium" is intended to mean a medium that is suitable for the topical administration of a composition.

A physiologically acceptable medium is preferentially a cosmetically or dermatologically acceptable medium, that is to say a medium which is devoid of unpleasant odour or appearance and which is entirely compatible with the topical administration route.

In the present case, where the composition is intended for topical administration, that is to say for administration by application at the surface of the keratin material under consideration, such a medium is considered in particular to be physiologically acceptable when it does not cause stinging, tightness or redness unacceptable to the user.

The term "deodorant active agent" is intended to mean, in the context of the present invention, any active agent which, by itself alone, has the effect of masking, absorbing, improving and/or reducing the unpleasant odour resulting from the decomposition of human sweat.

The term "antiperspirant active agent" is intended to mean any substance which, by itself alone, has the effect of reducing the flow of sweat, of reducing the
sensation on the skin of moisture associated with human sweat and of masking human sweat.

**HYDROPHOBIC SILICA PARTICLES**

The hydrophobic silica particles in accordance with the invention are hydrophobic silica particles that may be obtained by reaction: i) of at least one porous precipitated amorphous silica bearing surface hydroxyl groups with an alkyltrialkoxyxilane of formula (I) below:

\[ R_1\text{Si(OR}_2\text{)}_3 \] (I)

in which

- \( R_1 \) denotes a C\(_8\) to C\(_{20}\) alkyl group, optionally interrupted in its chain with an O or S atom or with an NH group or a carbonyl group (CO),
- \( R_2 \) denotes a C\(_1\)-C\(_4\) alkyl group and

ii) optionally at least one aminoalkyltrialkoxyxilane of formula (II) below:

\[ R_3\text{Si(OR}_3\text{)}_3 \] (II)

in which

- \( R_3 \) denotes a C\(_1\)-C\(_4\) alkyl group,
- \( R_4 \) denotes a linear or branched, saturated or unsaturated C\(_1\)-C\(_6\), or cyclic C\(_3\)-C\(_5\) hydrocarbon-based group, or denotes a C\(_6\)-C\(_9\) aryl or C\(_3\)-C\(_9\) aryloxy group

substituted with an amino group NH\(_2\) or NHR with R denoting a C\(_1\)-C\(_4\) alkyl radical, in an inert solvent, at a temperature ranging from 30°C to 200°C.

Advantageously, the porous particles of precipitated amorphous silica have a number-average particle size ranging from 1 to 25 \( \mu \)m and preferably ranging from 1 to 20 \( \mu \)m. Preferentially, they have a number-average size ranging from 1 to 10 \( \mu \)m.

The term "precipitated amorphous silica" means a silica generally obtained by the action of an acid on a sodium silicate solution. This type of silica comprises silanol groups on its surface.

The term "porous particles" denotes particles having a structure comprising pores. The porosity associated with the size of the particles is characterized quantitatively by their specific surface area. The porous particles of the invention advantageously have a specific surface area measured according to the BET method of greater than or equal to 100 m\(^2\)/g.

The BET (Brunauer-Emmett-Teller) method is a method that is well known to those skilled in the art. It is described especially in the *Journal of the American Chemical Society*, vol. 60, page 309, February 1938, and corresponds to international standard ISO 5794/1 (appendix D). The specific surface area measured according to the BET method corresponds to the total specific surface area, i.e., it includes the surface area formed by the pores.
According to a particular embodiment, the silica particles have a specific surface area measured by BET ranging especially from 300 to 1000 m²/g. Preferentially, the specific surface area ranges from 400 to 900 m²/g.

Spherical porous silica particles that may be used are those sold under the name Silica Beads SB-700 by the company Miyoshi; Sunsphere® H51, Sunsphere® H33 by the company Asahi Glass.

Preferably, R₁ represents a C₃-C₁₈ alkyl group and particularly an alkyl group chosen from n-octyl, n-decyl, n-dodecyl, n-tetradecyl, n-hexadecyl and n-octadecyl.

Preferably, R₂ represents an alkyl group comprising from 1 to 4 carbon atoms. More preferentially, R₂ represents a linear alkyl group comprising from 1 to 4 carbon atoms and more particularly an ethyl group.

As compound (I), use may be made of n-octyltrimethoxysilane, n-dodecyltrimethoxysilane, n-octadecyltrimethoxysilane, n-octyltriethoxysilane, n-dodecyltriethoxysilane or n-octadecyltriethoxysilane, and mixtures thereof.

According to one embodiment, compound (I) is n-dodecyltriethoxysilane.

According to another embodiment of the invention, compound (I) is n-octadecyltriethoxysilane.

According to another embodiment of the invention, compound (I) is n-octyltriethoxysilane.

Preferably, R₃ represents an alkyl group comprising from 1 to 4 carbon atoms. More preferentially, R₃ represents a linear alkyl group comprising from 1 to 4 carbon atoms and more particularly an ethyl group.

Preferably, R₄ represents a C₂-C₄ hydrocarbon-based group substituted with an amino group NH₂ or NHR with R =C₁-C₄ alkyl. More preferentially, R₄ represents a C₂-C₄ hydrocarbon-based group substituted with an amino group NH₂.

Preferably, the compound of formula (II) is chosen from 3-aminopropyltriethoxysilane (APTES), 3-amoethytriethoxysilane (AETES), 3-aminopropylmethyltriethoxysilane, N-(2-aminoethyl)-3-aminopropyltriethoxysilane, 3-(m-aminophenoxo)propyltrimethoxysilane, p-aminophenyltrimethoxysilane and N-(2-aminoethylaminomethyl)phenethyltrimethoxysilane.

More preferentially, compound (II) is chosen from 3-aminopropyltriethoxysilane (APTES), 3-aminoethyltriethoxysilane (AETES) and N-(2-aminoethyl)-3-aminopropyltriethoxysilane. More preferentially still, compound (II) is 3-aminopropyltriethoxysilane (APTES).
Advantageously, silica and compound (I) are used in a silica/compound (I) weight ratio ranging from 0.9 to 21.

Advantageously, silica and compound (II) are used in a silica/compound (II) weight ratio ranging from 5 to 21.

As inert solvents, use may be made of toluene, alkanes such as pentane, cyclopetane, hexane and cyclohexane, benzene, 1,4-dioxane, chloroform, dichloromethane, tetrahydrofuran, esters such as ethyl acetate and butyl acetate, formamides such as N,N-dimethylformamide (DMF), acetonitrile, dimethyl sulfoxide (DMSO), propylene carbonate, ketones such as methyl isobutyl ketone (MEK) and acetone, xylene, N-methylpyrrolidone and 1,3-dimethyl-3,4,5,6-tetrahydro-2(1H)-pyrimidinone (DMPU).

Toluene will preferably be used as inert solvent.

The reaction may be performed for a time ranging from 15 minutes to 2 days. Advantageously, the reaction is performed at a temperature ranging from 20 to 120°C.

The grafting reaction performed may be represented schematically in the following manner:

\[ \text{[Particle-SiO}_2\text{]}-(\text{OH})_3 + R_1\text{Si(OR}_2\text{)}_3 \rightarrow (\text{[Particle-SiO}_2\text{]}-\text{O})_3\text{-Si-R}_1 + 3 \text{ R}_2\text{OH} \]

The silica obtained thus comprises groups -(O-)_{3/2}Si-R_1, the radical R_1 being as defined previously.

In the compositions of the invention, the concentration of particles of hydrophobic modified silica in accordance with the invention preferably ranges from 0.1% to 100%, more preferentially from 1% to 70% and even more preferentially from 1% to 50% by weight relative to the total weight of the composition.

**COSMETIC COMPOSITION**

**Additional deodorant active agents**

The composition according to the invention may contain one or more additional deodorant active agents other than the hydrophobic silicas of the invention, for instance:

- bacteriostatic agents or other bactericidal agents such as 2,4,4'-trichloro-2'-hydroxydiphenyl ether (triclosan), 2,4-dichloro-2'-hydroxydiphenyl ether, 3',4',5'-trichlorosalicylanilide, 1-(3',4',5'-dichlorophenyl)-3-(4'-chlorophenyl)urea (triclocarban) or 3,7,11-trimethylododeca-2,5,10-trienol (Farnesol); quaternary ammonium salts, for instance cetyltrimethylammonium salts, cetylpyridinium salts; chlorhexidine and salts; diglyceryl monoglycerate, diglyceryl monolaurate or glycercyl monolaurate; polyhexamethylene biguanide salts;
- zinc salts, such as zinc salicylate, zinc phenolsulfonate, zinc pyrrolidonecarboxylate (more commonly known as zinc pidolate), zinc sulfate, zinc chloride, zinc lactate, zinc gluconate, zinc ricinoleate, zinc glycinate, zinc carbonate, zinc citrate, zinc chloride, zinc laurate, zinc oleate, zinc orthophosphate, zinc stearate, zinc tartrate, zinc lactate, zinc acetate or mixtures thereof;
- odour absorbers, such as zeolites, cyclodextrins, metal oxide silicates, such as those described in Application US 2005/063928, metal oxide particles modified by a transition metal, such as described in Applications US 2005/084464 and US 2005/084474, aluminosilicates, such as those described in Application EP 1 658 863, or particles of chitosan derivatives, such as those described in Patent US 6 916 465;
- substances which block the enzymatic reactions responsible for the formation of odorous compounds, such as arylsulfatase, 5-lipoxygenase, aminocyclase or β-glucuronidase inhibitors;

and mixtures thereof.

The additional deodorant active agents may be present in the composition according to the invention in a proportion of from 0.01% to 10% by weight and preferably in a proportion of from 0.1% to 5% by weight relative to the total weight of the composition.

**Antiperspirant active agents**

The composition according to the invention may contain one or more antiperspirant active agents.

The term "antiperspirant active agent" is intended to mean any substance which, by itself alone, has the effect of reducing the flow of sweat, of reducing the sensation on the skin of moisture associated with human sweat and of masking human sweat.

The antiperspirant active agents are preferably chosen from aluminium and/or zirconium salts; complexes of zirconium hydroxychloride and of aluminium hydroxychloride with an amino acid, such as those described in Patent US-3 792 068, commonly known as "ZAG" complexes. Such complexes are generally known under the name ZAG (when the amino acid is glycine). The ZAG complexes ordinarily exhibit an Al/Zr quotient ranging from approximately 1.67 to 12.5 and a metal/Cl quotient ranging from approximately 0.73 to 1.93. Mention may be made, among these products, of aluminium zirconium octachlorohydrex GLY, aluminium zirconium pentachlorohydrex GLY, aluminium zirconium tetrachlorohydrate GLY and aluminium zirconium trichlorohydrate GLY.

Among the aluminium salts that may be mentioned are aluminium chlorohydrate, aluminium chlorohydrex, aluminium chlorohydrex PEG, aluminium chlorohydrex PG, aluminium dichlorohydrate, aluminium dichlorohydrex PEG, aluminium dichlorohydrex PG, aluminium sesquichlorohydrate, aluminium sesquichlorohydrex PEG, aluminium sesquichlorohydrex PG, alum salts, aluminium sulfate, aluminium
zirconium octachlorohydrate, aluminium zirconium pentachlorohydrate, aluminium zirconium tetrachlorohydrate, aluminium zirconium trichlorohydrate and more particularly the aluminium hydroxychloride sold by the company Reheis under the name Reach 301 or by the company Guilini Chemie under the name Aloxicol PF 40. Aluminium zirconium salts are, for example, the salt sold by the company Reheis under the name Reach AZP-908-SUF.

Use will more particularly be made of aluminium chlorohydrate in the activated or non-activated form.

The antiperspirant active agents can be present in the composition according to the invention in a proportion of from 0.001% to 30% by weight and preferably in a proportion of from 0.5% to 25% by weight, relative to the total weight of the composition.

**GALENICAL FORMS**

The composition according to the invention may be in any galenical form conventionally used for topical application and especially in the form of aqueous gels, or aqueous or aqueous-alcoholic solutions. By adding a fatty or oily phase, it may also be in the form of dispersions of lotion type, emulsions of liquid or semi-liquid consistency of milk type, obtained by dispersing a fatty phase in an aqueous phase (O/W) or conversely (W/O), or suspensions or emulsions of soft, semi-solid or solid consistency of the cream or gel type, or alternatively multiple emulsions (W/O/W or O/W/O), microemulsions, vesicular dispersions of ionic and/or nonionic type, or wax/aqueous phase dispersions. These compositions are prepared according to the usual methods.

The compositions may especially be packaged in pressurized form in an aerosol device or in a pump-action bottle; packaged in a device equipped with a perforated wall, in particular a grate; packaged in a device equipped with a ball applicator ("roll-on"); packaged in the form of wands (sticks) or in the form of loose or compacted powder. In this regard, they contain the ingredients generally used in products of this type, which are well known to those skilled in the art.

According to another specific form of the invention, the compositions according to the invention can be anhydrous.

The term "anhydrous composition" is intended to mean a composition containing less than 2% by weight of water, indeed less than 0.5% of water, and in particular devoid of water, the water not being added during the preparation of the composition but corresponding to the residual water contributed by the mixed ingredients.

According to another particular form of the invention, the compositions according to the invention may be solid, in particular in wand or stick form.
The term "solid composition" is intended to mean that the measurement of the maximum force measured by texturometry during the penetration of a probe into the sample of formula must be at least equal to 0.25 newtons, in particular at least equal to 0.30 newtons and in particular at least equal to 0.35 newtons, assessed under precise measurement conditions as follows.

The formulae are poured hot into jars with a diameter of 4 cm and a depth of 3 cm. Cooling is carried out at room temperature. The hardness of the formulae produced is measured after an interval of 24 hours. The jars containing the samples are characterized in texturometry using a texture analyzer such as the machine sold by the company Rheo TA-XT2, according to the following protocol: a stainless-steel ball probe 5 mm in diameter is brought into contact with the sample at a speed of 1 mm/s. The measurement system detects the interface with the sample, with a detection threshold equal to 0.005 newtons. The probe penetrates 0.3 mm into the sample, at a speed of 0.1 mm/s. The measuring machine records the change in force measured in compression over time, during the penetration phase. The hardness of the sample corresponds to the average of the maximum force values detected during penetration, over at least three measurements.

AQUEOUS PHASE

The compositions according to the invention intended for cosmetic use may comprise at least one aqueous phase. They are in particular formulated as aqueous lotions or as water-in-oil or oil-in-water emulsions or as multiple emulsions (oil-in-water-in-oil or water-in-oil-in-water triple emulsions (such emulsions are known and described, for example, by C. Fox in "Cosmetics and Toiletries" - November 1986 - Vol. 101 - pages 101-112)).

The aqueous phase of said compositions contains water and generally other water-soluble or water-miscible solvents. The water-soluble or water-miscible solvents comprise short-chain, for example C₂-C₄, monoalcohols, such as ethanol or isopropanol; diols or polyols, such as ethylene glycol, 1,2-propylene glycol, 1,3-butylene glycol, hexylene glycol, diethylene glycol, dipropylene glycol, 2-ethoxyethanol, diethylene glycol monomethyl ether, triethylene glycol monomethyl ether and sorbitol. Use will more particularly be made of propylene glycol and glycerol, and propane-1,3-diol.

The composition according to the invention preferably has a pH ranging from 3 to 9, according to the support chosen.

EMULSIFIERS

Oil-in-water emulsifiers

As emulsifiers that may be used in the oil-in-water emulsions or oil-in-water-in-oil triple emulsions, examples that may be mentioned include nonionic emulsifiers such as oxyalkylenated (more particularly polyoxyethylated) fatty acid esters of glycerol; oxyalkylenated fatty acid esters of sorbitan; oxyalkylenated
(oxyethylenated and/or oxypropylenated) fatty acid esters; oxyalkylated
(oxyethylenated and/or oxypropylenated) fatty alcohol ethers; sugar esters such as
sucrose stearate; and mixtures thereof, such as the mixture of glyceryl stearate
and PEG-40 stearate.

Mention may also be made of fatty alcohol/alkylpolyglycoside emulsifying mixtures
as described in patent applications WO 92/06778, WO 95/13863 and WO
98/47610, for instance the commercial products sold by the company SEPPIC
under the name Montanov®.

Water-in-oil emulsifiers

Among the emulsifiers that may be used in the water-in-oil emulsions or water-in-
oil-in-water-in-oil triple emulsions, examples that may be mentioned include alkyl
dimethicone copolymers, for instance Cetyl PEG/PPG-10/1 Dimethicone and more
particularly the mixture Cetyl PEG/PPG-10/1 Dimethicone and Dimethicone (INCI
name), for instance the product sold under the trade name Abil EM90 by the
company Goldschmidt, or alternatively the mixture (Polyglyceryl-4 Stearate and
Cetyl PEG/PPG-10 (and) Dimethicone (and) Hexyl Laurate), for instance the
product sold under the trade name Abil WE09 by the same company.

Among the water-in-oil emulsifiers, mention may also be made of dimethicone
copolymers, for instance PEG-18/PPG-18 Dimethicone and more particularly the
mixture Cyclopentasiloxane (and) PEG-18/PPG-18 Dimethicone (INCI name),
such as the product sold by the company Dow Corning under the trade name
Silicone DC5225 C or KF-6040 from the company Shin-Etsu.

Among the water-in-oil emulsifiers, mention may also be made of nonionic
emulsifiers derived from fatty acids and polyol, alkylpolyglycosides (APG) and
sugar esters, and mixtures thereof.

As nonionic emulsifiers derived from fatty acids and polyols, use may be made
especially of fatty acid esters of polyols, the fatty acid especially containing a C₈-
C₂₄ alkyl chain, and the polyols being, for example, glycerol and sorbitan.

Mention may in particular be made, as fatty acid esters of polyols, of isostearic
acid esters of polyols, stearic acid esters of polyols, and mixtures thereof, in
particular isostearic acid esters of glycerol and/or sorbitan.

Stearic acid esters of polyols that may especially be mentioned include the
polyethylene glycol esters, for instance PEG-30 Dipolyhydroxystearate, such as
the product sold under the name Arlacel P135 by the company ICI.

Glycerol and/or sorbitan esters that may be mentioned, for example, include
polyglyceryl isostearate, such as the product sold under the name Isolan GI 34 by
the company Goldschmidt; sorbitan isostearate, such as the product sold under
the name Arlacel 987 by the company ICI; sorbitan glycercyl isostearate, such as
the product sold under the name Arlacel 986 by the company ICI, the mixture of
sorbitan isostearate and polyglyceryl isostearate (3 mol) sold under the name Arlacel 1690 by the company Uniqema, and mixtures thereof.

The emulsifier may also be chosen from alkylpolyglycosides with an HLB of less than 7, for example those represented by the general formula (1) below:

\[ R'-Q-(G)x \]  

(1)

in which \( R' \) represents a branched and/or unsaturated alkyl radical comprising from 14 to 24 carbon atoms, \( G \) represents a reduced sugar comprising 5 or 6 carbon atoms, and \( x \) is a value ranging from 1 to 10 and preferably from 1 to 4, and \( G \) especially denotes glucose, fructose or galactose.

The unsaturated alkyl radical may comprise one or more ethylenic unsaturations, and in particular one or two ethylenic unsaturations.

As alkylpolyglycosides of this type, mention may be made of alkylpolyglycosides (\( G = \) glucose in formula (I)), and especially the compounds of formula (I) in which \( R \) more particularly represents an oleyl radical (unsaturated \( \text{C}_{18} \) radical) or isostearyl (saturated \( \text{C}_{18} \) radical), \( G \) denotes glucose, and \( x \) is a value ranging from 1 to 2, especially isostearyl glucoside or oleyl glucoside, and mixtures thereof. This alkylpolyglucoside may be used as a mixture with a coemulsifier, more especially with a fatty alcohol and especially a fatty alcohol containing the same fatty chain as that of the alkylpolyglycoside, i.e. comprising from 14 to 24 carbon atoms and containing a branched and/or unsaturated chain, and for example isostearyl alcohol when the alkylpolyglucoside is isostearyl glucoside, and oleyl alcohol when the alkylpolyglucoside is oleyl glucoside, optionally in the form of a self-emulsifying composition, as described, for example, in the document WO-A-92/06778.

Mention may also be made of succinic-terminated polyolefins, for instance esterified succinic-terminated polyisobutylene and salts thereof, especially the diethanolamine salts, such as the products sold under the names Lubrizol 2724, Lubrizol 2722 and Lubrizol 5603 by the company Lubrizol or the commercial product Chemcinnate 2000.

The total amount of emulsifiers in the composition will preferably be, in the composition according to the invention, at active material contents ranging from 1% to 8% by weight and more particularly from 2% to 6% by weight, relative to the total weight of the composition.

**FATTY PHASE**

The compositions according to the invention may contain at least one water-immiscible organic liquid phase, known as a fatty phase. This phase generally comprises one or more hydrophobic compounds which render said phase water-immiscible. The said phase is liquid (in the absence of structuring agent) at room temperature (20-25°C). Preferentially, the water-immiscible organic liquid phase in
accordance with the invention generally comprises at least one volatile oil and/or one non-volatile oil and optionally at least one structuring agent.

The term "oil" means a fatty substance that is liquid at room temperature (25°C) and atmospheric pressure (760 mmHg, i.e. 10^5 Pa). The oil may be volatile or non-volatile.

For the purposes of the invention, the term "volatile oil" means an oil that is capable of evaporating on contact with the skin or the keratin fibre in less than one hour, at room temperature and atmospheric pressure. The volatile oils of the invention are volatile cosmetic oils which are liquid at room temperature and which have a non-zero vapour pressure, at room temperature and atmospheric pressure, ranging in particular from 0.13 Pa to 40 000 Pa (10^-3 to 300 mmHg), in particular ranging from 1.3 Pa to 13 000 Pa (0.01 to 100 mmHg) and more particularly ranging from 1.3 Pa to 1300 Pa (0.01 to 10 mmHg).

The term "non-volatile oil" means an oil that remains on the skin or the keratin fibre at room temperature and atmospheric pressure for at least several hours, and that especially has a vapour pressure of less than 10^-3 mmHg (0.13 Pa).

The oil can be chosen from any physiologically acceptable oils and in particular cosmetically acceptable oils, in particular mineral, animal, vegetable or synthetic oils; in particular volatile or non-volatile hydrocarbon-based oils and/or silicone oils and/or fluoro oils, and mixtures thereof.

More specifically, the term "hydrocarbon-based oil" is intended to mean an oil mainly comprising carbon and hydrogen atoms and optionally one or more functions chosen from hydroxyl, ester, ether and carboxylic functions. Generally, the oil has a viscosity of from 0.5 to 100 000 mPa.s, preferably from 50 to 50 000 mPa.s and more preferably from 100 to 300 000 mPa.s.

As examples of volatile oils that may be used in the invention, mention may be made of:
- volatile hydrocarbon-based oils chosen from hydrocarbon-based oils containing from 8 to 16 carbon atoms, and in particular C8-C16 isoalkanes of petroleum origin (also known as isoparaffins), for instance isododecane (also known as 2,2,4,4,6-pentamethylexane), isodecane and isoheptadecane, and for example the oils sold under the trade names Isopar or Permethyl, branched C8-C16 esters and isohexyl neopentanoate, and mixtures thereof. Use may also be made of other volatile hydrocarbon-based oils, such as petroleum distillates, in particular those sold under the name Shell Solt by the company Shell; and volatile linear alkanes, such as those described in Patent Application DE10 2008 012 457 from the company Cognis;
- volatile silicones, for instance linear or cyclic volatile silicone oils, in particular those with a viscosity of ≤ 8 centistokes (8 × 10^-6 m^2/s) and especially containing from 2 to 7 silicon atoms, these silicones optionally comprising alkyl or alkoxy groups containing from 1 to 10 carbon atoms. As volatile silicone oils that may be used in the invention, mention may be made especially of
octamethylcyclotetrasiloxane, decamethylcyclopentasiloxane,
dodecamethylcyclohexasiloxane, heptamethyltrihexyltrimethylsiloxane,
heptamethyloctyltrimethylsiloxane, hexamethylidisiloxane, octamethyltrisiloxane,
decamethyltetrasiloxane and dodecamethylpentasiloxane;

- and mixtures thereof.

Mention may also be made of linear volatile alkyltrisiloxane oils of general formula (I):

$$\text{CH}_3 \quad \{\text{CH}_3\}_3 \text{SiO} - \text{Si} - \text{O} - \text{Si}\{\text{CH}_3\}_3 \quad \text{R}$$

where R represents an alkyl group comprising from 2 to 4 carbon atoms, one or more hydrogen atoms of which can be replaced by a fluorine or chlorine atom.

Mention may be made, among the oils of general formula (I), of:

- 3-butyl-1,1,1,3,5,5,5-heptamethyltrisiloxane,
- 3-propyl-1,1,1,3,5,5,5-heptamethyltrisiloxane, and
- 3-ethyl-1,1,1,3,5,5,5-heptamethyltrisiloxane,

corresponding to the oils of formula (I) for which R is, respectively, a butyl group, a propyl group or an ethyl group.

As examples of nonvolatile oils that may be used in the invention, mention may be made of:

- hydrocarbon-based oils of animal origin, such as perhydrosqualene;
- vegetable hydrocarbon-based oils, such as liquid triglycerides of fatty acids containing 4 to 24 carbon atoms, such as heptanoic or octanoic acid triglycerides,
- or else wheat germ oil, olive oil, sweet almond oil, palm oil, rapeseed oil, cottonseed oil, alfalfa oil, poppy seed oil, pumpkin seed oil, blackcurrant oil, evening primrose oil, millet oil, barley oil, quinoa oil, rye oil, safflower oil, candlenut oil, passionflower oil, musk rose oil, sunflower oil, maize oil, soybean oil, rapeseed oil, grape seed oil, sesame oil, hazelnut oil, apricot oil, macadamia oil, castor oil, avocado oil, caprylic/capric acid triglycerides, such as those sold by the company Stearineries Dubois or those sold under the names Miglyol 810, 812 and 818 by the company Dynamit Nobel, jojoba oil or shea butter oil;
- linear or branched hydrocarbons of mineral or synthetic origin, such as liquid paraffins and derivatives thereof, petroleum jelly, polydecenes, polybutenes, hydrogenated polyisobutene, such as Parleam, or squalane;
- synthetic ethers containing from 10 to 40 carbon atoms;
- synthetic esters, especially of fatty acids, for instance the oils of formula \( R_1 \text{COOR}_2 \) in which \( R_1 \) represents a linear or branched higher fatty acid residue containing from 1 to 40 carbon atoms and \( R_2 \) represents a hydrocarbon-based chain, which is especially branched, containing from 1 to 40 carbon atoms, with \( R_1 + R_2 \geq 10 \), for instance purcellin oil (cetostearyl octanoate), isononyl isononanoate, isopropyl myristate, isopropyl palmitate, \( \text{C}_{12-15} \) alkyl benzoates, hexyl laurate, diisopropyl adipate, isononyl isononanoate, 2-ethyhexyl palmitate, 2-octyldecyl
stearate, 2-octylidodecyl erucate, isostearyl isostearate or tridecyl trimellitate; alcohol or polyalcohol octanoates, decanoates or ricinoleates, for instance propylene glycol dioctanoate; hydroxylated esters, for instance isostearyl lactate, octyl hydroxy stearate, octylidodecyl hydroxy stearate, diisostearyl malate, trisocetyl citrate, and fatty alcohol heptanoates, octanoates or decanoates; polyol esters, for instance propylene glycol dioctanoate, neopentyl glycol dioleate or diethylene glycol diisononanoate; and pentaerythritol esters, for instance pentaerythrityl tetraisostearate;
- fatty alcohols that are liquid at room temperature, containing a branched and/or unsaturated carbon-based chain containing from 12 to 26 carbon atoms, for instance octyldodecanol, isostearyl alcohol, 2-butyloctanol, 2-hexyldecanol, 2-undecylpentadecanol or oleyl alcohol;
- higher fatty acids such as oleic acid, linoleic acid or linolenic acid;
- carbonates;
- acetates;
- citrates;
- fluoro oils that are optionally partially hydrocarbon-based and/or silicone-based, for instance fluorosilicone oils, fluoro polyethers and fluorosilicones as described in document EP-A-847 752;
- silicone oils, for instance linear or cyclic non-volatile polydimethylsiloxanes (PDMS); polydimethylsiloxanes comprising alkyl, alkoxy or phenyl groups, which are pendant or at the end of a silicone chain, these groups containing from 2 to 24 carbon atoms; phenyl silicones, for instance phenyl trimethicones, phenyl dimethicones, phenyl trimethylsiloxy diphenyl siloxanes, diphenyl dimethicones, diphenyl methyl diphenyl trisiloxanes and 2-phenylethyl trimethylsiloxy silicates, and
mixtures thereof.

**Additives**

The cosmetic compositions according to the invention may also comprise cosmetic adjuvants chosen from softeners, antioxidants, opacifiers, stabilizers, moisturizers, vitamins, bactericides, preserving agents, polymers, fragrances, a structuring agent for a fatty phase, in particular chosen from waxes, pasty compounds, and mineral or organic lipophilic gelling agents; organic or mineral fillers; thickeners or suspending agents, propellants or any other ingredient usually used in cosmetics for this type of application.

Needless to say, a person skilled in the art will take care to select this or these optional additional compounds such that the advantageous properties intrinsically associated with the cosmetic composition in accordance with the invention are not, or are not substantially, adversely affected by the envisaged addition(s).

**Wax(es)**

The wax is in general a lipophilic compound that is solid at room temperature (25°C), with a reversible solid/liquid change in state, having a melting point of
greater than or equal to 30°C, which may be up to 200°C and in particular up to 120°C.

In particular, the waxes that are suitable for use in the invention may have a melting point of greater than or equal to 45°C and in particular of greater than or equal to 55°C.

For the purposes of the invention, the melting point corresponds to the temperature of the most endothermic peak observed in thermal analysis (DSC) as described in the standard ISO 11357-3; 1999. The melting point of the wax may be measured using a differential scanning calorimeter (DSC), for example the calorimeter sold under the name MDSC 2920 by the company TA Instruments.

The measuring protocol is as follows:

A sample of 5 mg of wax placed in a crucible is subjected to a first temperature rise ranging from -20°C to 100°C, at a heating rate of 10°C/minute, it is then cooled from 100°C to -20°C at a cooling rate of 10°C/minute and it is finally subjected to a second temperature rise ranging from -20°C to 100°C at a heating rate of 5°C/minute. During the second temperature rise, the variation in the difference in power absorbed by the empty crucible and by the crucible containing the sample of wax is measured as a function of the temperature. The melting point of the compound is the temperature value corresponding to the top of the peak of the curve representing the variation in the difference in power absorbed as a function of the temperature.

The waxes that may be used in the compositions according to the invention are chosen from waxes that are solid at room temperature of animal, vegetable, mineral or synthetic origin, and mixtures thereof.

As illustrations of waxes that are suitable for the invention, mention may be made especially of hydrocarbon-based waxes, for instance beeswax, lanolin wax, Chinese insect waxes, rice bran wax, carnauba wax, candelilla wax, ouricury wax, esparto grass wax, berry wax, shellac wax, Japan wax and sumach wax; montan wax, orange wax and lemon wax, refined sunflower wax sold under the name Sunflower Wax by Koster Keunen, microcrystalline waxes, paraffins and ozokerite; polyethylene waxes, the waxes obtained by Fischer-Tropsch synthesis and waxy copolymers, and also esters thereof.

Mention may also be made of waxes obtained by catalytic hydrogenation of animal or plant oils containing linear or branched C₉-C₃₂ fatty chains. Mention may especially be made, among these waxes, of isomerized jojoba oil such as the trans-isomerized partially hydrogenated jojoba oil manufactured or sold by the company Desert Whale under the commercial reference Iso-Jojoba-50®, hydrogenated sunflower oil, hydrogenated castor oil, hydrogenated coconut oil, hydrogenated lanolin oil and bis(1,1,1-trimethylolpropane) tetrastearate sold under the name Hest 2T-4S® by the company Heterene.
Mention may also be made of silicone waxes (C_{30-45} alkyl dimethicone) and fluoro waxes.

The waxes obtained by hydrogenation of castor oil esterified with cetyl alcohol, sold under the names Phytowax ricin 16L64® and 22L73® by the company Sophim, may also be used. Such waxes are described in patent application FR-A-2 792 190.

As wax, use may be made of a C_{20-40} alkyl (hydroxystearoxy)stearate (the alkyl group comprising from 20 to 40 carbon atoms), alone or as a mixture.

Such a wax is especially sold under the names Kester Wax K 82 P®, Hydroxypolyester K 82 P® and Kester Wax K 80 P® by the company Koster Keunen.

As microwaxes that may be used in the compositions according to the invention, mention may be made especially of carnauba microwaxes, such as the product sold under the name MicroCare 350® by the company Micro Powders, synthetic microwaxes, such as the product sold under the name MicroEase 114S® by the company Micro Powders, microwaxes consisting of a mixture of carnauba wax and polyethylene wax, such as the products sold under the names Micro Care 300® and 310® by the company Micro Powders, microwaxes consisting of a mixture of carnauba wax and of synthetic wax, such as the product sold under the name Micro Care 325® by the company Micro Powders, polyethylene microwaxes, such as the products sold under the names Micropoly 200®, 220®, 220L® and 250S® by the company Micro Powders, the commercial products Performalene 400 Polyethylene and Performalene 500-L Polyethylene from New Phase Technologies, Performalene 655, Polyethylene® or paraffin waxes, for instance the wax having the INCI name Microcrystalline Wax and Synthetic Wax and sold under the trade name Microlease by the company Sochibo; polytetrafluoroethylene microwaxes such as those sold under the names Microslip 519® and 519 L® by the company Micro Powders.

**Pasty compounds**

For the purposes of the present invention, the term “pasty compound” means a lipophilic fatty compound that undergoes a reversible solid/liquid change of state, having in the solid state an anisotropic crystal organization, and comprising, at a temperature of 23°C, a liquid fraction and a solid fraction.

The pasty compound is preferably chosen from synthetic compounds and compounds of plant origin. A pasty compound may be obtained by synthesis from starting materials of plant origin.

The pasty compound may be advantageously chosen from:
- lanolin and derivatives thereof,
- polymeric or non-polymeric silicone compounds,
- polymeric or non-polymeric fluoro compounds,
- vinyl polymers, especially:
- olefin homopolymers,
- olefin copolymers,
- hydrogenated diene homopolymers and copolymers,
- linear or branched oligomers, homopolymers or copolymers of alkyl (meth)acrylates preferably containing a C₈-C₃₀ alkyl group,
- homo- and copolymeric oligomers of vinyl esters containing C₈-C₃₀ alkyl groups,
- homo- and copolymeric oligomers of vinyl ethers having C₈-C₃₀ alkyl groups,
- liposoluble polyethers resulting from polyetherification between one or more C₄-
C₁₀₀, preferably C₂-C₅₀, diols,
- esters,
- mixtures thereof.

**Lipophilic gelling agents**

Lipophilic gelling agents that may be mentioned include optionally modified clays, for instance hectorites modified with a C₁₀ to C₂₂ ammonium chloride, for instance hectorite modified with diestearyldimethylammonium chloride, for instance the product sold under the name Bentone 38V® by the company Elementis.

**Thickeners and Suspending agents**

The thickeners may be chosen from carboxyvinyl polymers, such as Carbopol (Carbomers) and the Pemulens (acrylate/C₁₀-C₃₀ alkyl acrylate copolymer); polyacrylamides, for instance the crosslinked copolymers sold under the names Sepigel 305 (CTFA name: polyacrylamide/C₁₃-₁₄ isoparaffin/Laureth 7) or Simulgel 600 (CTFA name: acrylamide/sodium acryloyldimethyltaurate copolymer/isohexadecane/polyisorbate 80) by the company SEPPIC; 2-acrylamido-2-methylpropanesulfonic acid polymers and copolymers, optionally crosslinked and/or neutralized, for instance poly(2-acrylamido-2-methylpropanesulfonic acid) sold by the company Hoechst under the trade name Hostacerin AMPS (CTFA name: ammonium polyacryloyldimethyltaurate or Simulgel 800 sold by the company SEPPIC (CTFA name: sodium polyacryloyldimethyltaurate/polyisorbate 80/sorbitan oleate); copolymers of 2-acrylamido-2-methylpropanesulfonic acid and of hydroxyethyl acrylate, for instance Simulgel NS and Sepinov EMT 10 sold by the company SEPPIC; cellulose derivatives such as hydroxyethyl cellulose or cetyl hydroxyethyl cellulose; polysaccharides and especially gums such as xanthan gum and hydroxypropyl guar gums; silicas, for instance Bentone Gel MIO sold by the company NL Industries or Veegum Ultra sold by the company Polyplastic.

**Suspending agents**

In order to improve the homogeneity of the product, use may additionally be made of one or more suspending agents which are preferably chosen from hydrophobic modified montmorillonite clays, such as hydrophobic modified bentonites or hectorites. Examples that may be mentioned include the product Stearalkonium
Bentonite (CTFA name) (product of reaction of bentonite and the quaternary ammonium stearalkonium chloride) such as the commercial product sold under the name Tixogel MP 250 by the company Sud Chemie Rheologicals, United Catalysts Inc. or the product Distearidimonium Hectorite (CTFA name) (product of reaction of hectorite and distearyldimonium chloride) sold under the name Bentone 38 or Bentone Gel by the company Elementis Specialties.

Other suspension agents may be used, in the present case in hydrophilic media (aqueous and/or ethanolic). They can be derivatives of cellulose, xanthan, guar, starch, locust bean or agar agar.

The suspending agents are preferably present in amounts ranging from 0.1% to 5% by weight and more preferentially from 0.2% to 2% by weight relative to the total weight of the composition.

The amounts of these various constituents that may be present in the cosmetic composition according to the invention are those conventionally used in compositions for treating perspiration.

**Aerosols**

The compositions according to the invention may also be pressurized and may be packaged in an aerosol device formed by:

(A) a container comprising an antiperspirant composition as defined previously,

(B) at least one propellant and a means for dispensing said aerosol composition.

The propellants generally used in products of this type and that are well known to those skilled in the art are, for instance, dimethyl ether (DME); volatile hydrocarbons such as n-butane, propane, isobutane and mixtures thereof, optionally with at least one chlorohydrocarbon and/or fluorohydrocarbon; among these derivatives, mention may be made of the compounds sold by the company DuPont de Nemours under the names Freon® and Dymel®, and in particular monofluorotrichloromethane, difluorodichloromethane, tetrafluorodichloroethane and 1,1-difluoroethane sold especially under the trade name Dymel 152 A by the company DuPont. Carbon dioxide, nitrous oxide, nitrogen or compressed air may also be used as propellant.

The compositions comprising perlite particles as defined above and the propellant(s) can be in the same compartment or in different compartments in the aerosol container. According to the invention, the concentration of propellant generally varies from 5% to 95% by weight pressurized and more preferentially from 50% to 85% by weight, relative to the total weight of the pressurized composition.

The dispensing means, which forms a part of the aerosol device, is generally formed by a dispensing valve controlled by a dispensing head, which itself comprises a nozzle via which the aerosol composition is vaporized. The container containing the pressurized composition may be opaque or transparent. It can be
made of glass, of polymer or of metal, optionally covered with a protective lacquer layer.

The terms "between... and..." and "ranging from... to..." should be understood as being limits inclusive, unless otherwise specified.

The examples which follow illustrate the present invention without limiting the scope thereof.

**PREPARATION EXAMPLES**

**Example 1:**

A mixture of 8 g of amorphous silica microspheres (particle size: 5 microns; Sunsphere H 51 from AGC Si-Tech) and 8 g of n-dodecyltriethoxysilane in 300 ml of toluene was refluxed for 8 hours in a three-necked flask equipped with a condenser, and was then allowed to cool for two nights. The lower phase of the resulting two-phase solution was recovered and then centrifuged at 4000 rpm for 4 minutes. The precipitate obtained was triturated in 200 ml of ethanol and then centrifuged. This cycle of washing and centrifugation was repeated with ethanol and then twice with distilled water (200 ml). The precipitate was dried under vacuum at 80°C for 8 hours. 7.5 g of a white powder were obtained.

**Example 2:**

The powder was prepared according to the procedure of Example 1, using 10 g of amorphous silica microspheres (particle size: 5 microns; Sunsphere H 51 from AGC Si-Tech) and 10 g of n-octyltriethoxysilane in 300 ml of toluene. 9.2 g of a white powder were obtained.

**Example 3:**

The powder was prepared according to the procedure of Example 1, using 8 g of amorphous silica microspheres (particle size: 5 microns; Sunsphere H 51 from AGC Si-Tech) and 0.8 g of n-octadecyltriethoxysilane in 300 ml of toluene. 6.6 g of a white powder were obtained.

**Example 4:**

A mixture of 6 g of amorphous silica microspheres (particle size: 5 microns; Sunsphere H 51 from AGC Si-Tech), 0.3 g of n-octadecyltriethoxysilane and 0.3 g of 3-aminopropyltriethoxysilane in 200 ml of toluene was refluxed for 8 hours in a three-necked flask equipped with a condenser, and was then allowed to cool overnight. The lower phase of the resulting two-phase solution was recovered and then poured into 200 ml of ethanol. The mixture was centrifuged at 4000 rpm for 4 minutes. The precipitate obtained was washed with 200 ml of ethanol and then centrifuged, and then twice with distilled water (200 ml). The precipitate was dried under vacuum at 80°C for 24 hours. 4.2 g of a white powder were obtained.

**Example 5:**
The powder was prepared according to the procedure of Example 1, using 3.20 g of amorphous silica microspheres (particle size: 5 microns; Sunsphere H 51 from AGC Si-Tech), 0.16 g of n-octyltriethoxysilane and 0.16 g of 3-aminopropyltriethoxysilane in 100 ml of toluene. 2.8 g of a white powder were obtained.

**COMPARATIVE TESTS OF DEODORANT EFFICACY**

Two deodorant pastes according to the invention containing the treated silica of Example 2 (formula C) and of Example 5 (formula D) and two deodorant pastes similar to paste C, in which the treated silica was replaced, respectively, with untreated silica (Sunsphere H51 (formula A) and with hydrophobic fumed silica Aerosil R972 (formula B), were prepared.

The formulae are as follows (contents expressed as weight percentages):

<table>
<thead>
<tr>
<th>Ingredients (INCI name)</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polydimethylsiloxane (10 cSt)</td>
<td>A  B</td>
</tr>
<tr>
<td>(Xiameter PMX-200®)</td>
<td>37 37</td>
</tr>
<tr>
<td>Isopropyl palmitate</td>
<td>25 25</td>
</tr>
<tr>
<td>Isopropyl myristate</td>
<td>23 23</td>
</tr>
<tr>
<td>Dimethiconol (Xiameter PMX1502)</td>
<td>6 6</td>
</tr>
<tr>
<td>Polydimethylsiloxane (1000 cSt)</td>
<td>A  B</td>
</tr>
<tr>
<td>(Dow Corning silicone fluid SH 200®)</td>
<td>3 3</td>
</tr>
<tr>
<td>Unmodified silica (Sunsphere H 51®)</td>
<td>6 -</td>
</tr>
<tr>
<td>Hydrophilic fumed silica (Aerosil R 972®)</td>
<td>- 6</td>
</tr>
<tr>
<td>Hydrophobic modified silica of Example 2</td>
<td>- -</td>
</tr>
<tr>
<td>Hydrophobic modified silica of Example 5</td>
<td>- -</td>
</tr>
</tbody>
</table>

The deodorant efficacy of each formula was evaluated according to the following protocol:

0.5 g of formula was applied to the surface of an armpit. The armpits were washed with toiletry soap and then rinsed and dried (towel) before applying the product. One armpit was not treated and served as a reference for the evaluation.

After 24 hours, evaluations by direct "sniff test" of the intensity of the odour under the armpits were performed after application of a test composition and compared with the intensity of the odour under the untreated armpit.
The deodorant efficacy was evaluated according to the following two criteria:
The intensity of the odour on a scale from 1 to 10. 1 represents an imperceptible intensity and 10 represents an odour equivalent to that of the untreated armpit. The lower the value, the weaker the odour.

The hedonic value on a scale from 1 to 10. 1 represents an odour that is as unpleasant as that under the untreated armpit and 10 represents an extremely pleasant odour. The higher the value, the more the unpleasantness decreases.

Results

<table>
<thead>
<tr>
<th>Formula</th>
<th>Odour intensity</th>
<th>Hedonic value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula A</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Formula B</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Formula C</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Formula D</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

The results show that compositions C and D according to the invention make it possible to reduce efficiently the intensity of the odour.

Example 6: Anhydrous deodorant stick

<table>
<thead>
<tr>
<th>Ingredients (INCI name)</th>
<th>Amounts (weight%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclopentasiloxane (DC 245® - Dow Corning)</td>
<td>38</td>
</tr>
<tr>
<td>PPG-14 Butyl ether (Ucon fluid AP® - Amerchol)</td>
<td>10</td>
</tr>
<tr>
<td>Hydrogenated castor oil (Cutina HR® - Cognis)</td>
<td>4</td>
</tr>
<tr>
<td>Stearyl alcohol (Lorol C18 - Cognis)</td>
<td>14</td>
</tr>
<tr>
<td>PEG-8 distearate (Stéarinesies Dubois)</td>
<td>2</td>
</tr>
<tr>
<td>C12-15 alkyl benzoate (Finsolv TN® - Witco)</td>
<td>15</td>
</tr>
<tr>
<td>Hydrophobic modified</td>
<td>17</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Silica according to one of Examples 1 to 5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

**Procedure:**

The cyclopentasiloxane was heated to 65°C. The other ingredients were added (one by one), while keeping the temperature at 65-70°C. The whole was homogenized (transparent solution) for 15 minutes. The particles of hydrophobic silica were added. The product was cooled to about 55°C (a few degrees above the thickening point of the mixture) and poured into sticks. The sticks were placed at 4°C for 30 minutes.

The composition applied to the armpits reduces the odour caused by perspiration.

**Example 7: Deodorant emulsion (roll-on)**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Ingredients (INCI name)</th>
<th>Amounts (weight%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Hydrophobic modified silica according to one of Examples 1 to 5</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>Steareth-21 (Brij 721® - ICI)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Steareth-2 (Brij 72 - ICI)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>PPG-15 stearyl ether (Arlamol E® - ICI)</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Cyclopentasiloxane (DC 245® - Dow Corning)</td>
<td>3.5</td>
</tr>
<tr>
<td>C</td>
<td>Water</td>
<td>qs for 100</td>
</tr>
</tbody>
</table>

**Procedure:**

Phases (B) and (C) were separately heated to 70°C. Phases (B) and (C) were mixed together with a Turrax blender for 5 minutes, and the mixture was then cooled to 55°C with paddle stirring. Phase A was then added slowly with stirring. The mixture was homogenized for 1 to 3 minutes. The mixture was cooled to 35°C with stirring.

The composition applied to the armpits reduces the odour caused by perspiration.

**Example 8: Deodorant and antiperspirant emulsion (roll-on)**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Ingredients (INCI name)</th>
<th>Amounts</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Ingredients (INCI name)</th>
<th>Amounts (weight%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Aluminium chloride (50% solution)</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>(Chlorhydrol® 50% - USP)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hydrophobic modified silica according to one of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Examples 1 to 5</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Steareth-21 (Brij 721® - ICI)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Steareth-2 (Brij 72 - ICI)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>PPG-15 stearyl ether (Arlamol E® - ICI)</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Cyclopentasiloxane (DC 245® - Dow Corning)</td>
<td>3.5</td>
</tr>
<tr>
<td>C</td>
<td>Water</td>
<td>qs for 100</td>
</tr>
</tbody>
</table>

**Procedure:**

Phases (B) and (C) were separately heated to 70°C. Phases (B) and (C) were mixed together with a Turrax blender for 5 minutes, and the mixture was then cooled to 55°C with paddle stirring. Phase A was then added slowly with stirring. The mixture was homogenized for 1 to 3 minutes. The mixture was cooled to 35°C with stirring. The composition applied to the armpits reduces the odour caused by perspiration.

**Example 9: Deodorant paste**

<table>
<thead>
<tr>
<th>Ingredients (INCI name)</th>
<th>Amounts (weight%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triethyl citrate (Citroflex2® - Reilly Chemicals)</td>
<td>7</td>
</tr>
<tr>
<td>Isopropyl palmitate (Cognis)</td>
<td>6</td>
</tr>
<tr>
<td>Hydrophobic modified silica according to one of</td>
<td>17.5</td>
</tr>
<tr>
<td>Examples 1 to 5</td>
<td></td>
</tr>
<tr>
<td>Cyclomethicone (Dow Corning 245 Fluid®)</td>
<td>60.5</td>
</tr>
<tr>
<td>Cyclopentasiloxane (and) Dimethiconol (Dow Corning</td>
<td>9</td>
</tr>
<tr>
<td>1501 Fluid®)</td>
<td></td>
</tr>
</tbody>
</table>
The particles of hydrophobic modified silica were dispersed in the mixture of the other starting materials using a paddle. A homogeneous paste was obtained.

The composition applied to the armpits reduces the odour caused by perspiration.

**Example 10: Aerosol**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Ingredients (INCI name)</th>
<th>Amounts (weight%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Triethyl citrate (Citroflex2® - Reilly Chemicals)</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>Stearalkonium bentonite</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>Isopropyl palmitate (Cognis)</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>Hydrophobic modified silica according to one of Examples 1 to 5</td>
<td>2.625</td>
</tr>
<tr>
<td></td>
<td>Cyclomethicone (Dow Corning 245 Fluid®)</td>
<td>9.075</td>
</tr>
<tr>
<td></td>
<td>Cyclopentasiloxane (and) Dimethiconol (Dow Corning 1501 Fluid®)</td>
<td>1.35</td>
</tr>
<tr>
<td>B</td>
<td>Isobutane</td>
<td>85</td>
</tr>
</tbody>
</table>

**Procedure:**

The particles of hydrophobic modified silica were dispersed in the mixture of the other starting materials constituting phase A, using a paddle. The mixture was pressurized with isobutane in an aerosol can.

The composition applied to the armpits reduces the odour caused by perspiration.
CLAIMS

1. Cosmetic use, as deodorant active agent, of hydrophobic silica particles that may be obtained by reaction:
   i) of at least one precipitated porous amorphous silica comprising surface hydroxyl groups with an alkylderivatizedsilane of formula (I) below:

   \[ R_1 Si(OR_2)_3 \]  \( (I) \)

   in which
   \( R_1 \) denotes a C\(_8\) to C\(_{20}\) alkyl group, optionally interrupted in its chain with an O or S atom or with an NH group or a carbonyl group (CO),
   \( R_2 \) denotes a C\(_1\)-C\(_4\) alkyl group and
   ii) optionally at least one aminoalkylderivatizedsilane of formula (II) below:

   \[ R_3 Si(OR_3)_3 \]  \( (II) \)

   in which
   \( R_3 \) denotes a C\(_1\)-C\(_4\) alkyl group,
   \( R_4 \) denotes a linear or branched, saturated or unsaturated C\(_1\)-C\(_6\), or cyclic C\(_3\)-C\(_5\) hydrocarbon-based group, or denotes a C\(_9\)-C\(_9\) aryl or C\(_9\)-C\(_9\) aryloxy group substituted with an amino group NH\(_2\) or NHR with R denoting a C\(_1\)-C\(_4\) alkyl radical, in an inert solvent, at a temperature ranging from 30°C to 200°C.

2. Use according to Claim 1, in which the hydrophobic silica particles are present in a composition comprising a cosmetically acceptable medium.

3. Use according to Claim 1 or 2, the porous particles of precipitated amorphous silica having a number-average particle size ranging from 1 to 25 \( \mu \)m and preferably ranging from 1 to 20 \( \mu \)m; preferentially, they have a number-average size ranging from 3 to 10 \( \mu \)m.

4. Use according to any one of Claims 1 to 3, in which the porous particles of precipitated amorphous silica have a specific surface area measured by BET ranging especially from 300 to 1000 m\(^2\)/g and preferably the specific surface area ranges from 400 to 900 m\(^2\)/g.

5. Use according to any one of Claims 1 to 4, in which the compound of formula (I) is chosen from those in which \( R_1 \) represents a C\(_8\) to C\(_{18}\) alkyl group and chosen especially from n-octyl, n-decyl, n-dodecyl, n-tetradecyl, n-hexadecyl and n-octadecyl.

6. Use according to any one of Claims 1 to 5, in which the compound of formula (I) is chosen from those in which \( R_2 \) represents an alkyl group comprising from 1 to 4 carbon atoms, more preferentially chosen from those in which \( R_2 \) represents a linear alkyl group comprising from 1 to 4 carbon atoms and more particularly an ethyl group.
7. Use according to Claim 5 or 6, in which the compound of formula (I) is chosen from octyltrimethoxysilane, n-dodecyltrimethoxysilane, n-octadecyltrimethoxysilane, n-octyltriethoxysilane, n-dodecyltriethoxysilane and n-octadecyltriethoxysilane, and mixtures thereof, and is more particularly chosen from dodecyltriethoxysilane, n-octadecyltriethoxysilane and n-octyltriethoxysilane.

8. Use according to any one of Claims 1 to 7, in which the compound of formula (II) is chosen from those in which R₃ represents an alkyl group comprising from 1 to 4 carbon atoms, more preferentially chosen from those in which R₃ represents a linear alkyl group comprising from 1 to 4 carbon atoms and more particularly an ethyl group.

9. Use according any to one of Claims 1 to 8, in which the compound of formula (II) is chosen from those in which R₄ represents a C₂-C₄ hydrocarbon-based group substituted with an amino group NH₂ or NHR with R = C₁-C₄ alkyl, and more preferentially chosen from those in which R₄ represents a C₂-C₄ hydrocarbon-based group substituted with an amino group NH₂.

10. Use according to Claim 8 or 9, in which the compound of formula (II) is chosen from 3-aminopropyltriethoxysilane (APTES), 3-aminoethyltriethoxysilane (AETES), N-(2-aminoethyl)-3-aminopropyltriethoxysilane, 3-(m-aminophenoxy)propyltrimethoxysilane, p-aminophenyltrimethoxysilane, N-(2-aminoethylaminomethyl)phenethyltrimethoxysilane and more preferentially 3-aminopropyltriethoxysilane (APTES).

11. Use according to any one of Claims 1 to 10, in which silica and compound (I) are used in a silica/compound (I) weight ratio ranging from 0.9 to 21 and advantageously in a silica/compound (II) weight ratio ranging from 10 to 21.

12. Use according to any one of Claims 1 to 11, in which the inert solvent is chosen from toluene, alkanes, benzene, 1,4-dioxane, chloroform, dichloromethane, tetrahydrofuran, esters, formamides, acetonitrile, dimethyl sulfoxide, propylene carbonate, ketones, N-methylpyrrolidone and 1,3-dimethyl-3,4,5,6-tetrahydro-2(1H)-pyrimidinone.

13. Cosmetic process for treating human body odour and optionally human perspiration, which consists in applying to human keratin materials hydrophobic silica particles as defined according to any one of the preceding claims or a composition containing the same in a cosmetically acceptable medium.

14. Composition, characterized in that it comprises, in a cosmetically acceptable medium:
   a) at least hydrophobic silica particles as defined in any one of the preceding claims and
   b) at least one deodorant active agent other than the said hydrophobic silica particles and/or at least one antiperspirant active agent.

15. Composition according to Claim 14, packaged:
(i) in pressurized form in an aerosol device or in a pump-action bottle;
(ii) in a device equipped with a perforated wall, in particular a grate;
(iii) in a device equipped with a ball applicator;
(iv) in the form of a wand; or
(v) in the form of loose or compacted powder.
## INTERNATIONAL SEARCH REPORT

**PCT/EP2014/060060**

### A. CLASSIFICATION OF SUBJECT MATTER

<table>
<thead>
<tr>
<th>INV.</th>
<th>A61K8/25</th>
<th>A61Q15/00</th>
<th>A61K8/893</th>
<th>A61K8/02</th>
<th>A61K8/04</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADD.</td>
<td>A61K</td>
<td>A61Q</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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)

- A61K
- A61Q

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 applicable, search terms used)

- EPO-Internal, WPI Data

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>US 4 605 554 A (PRUSSIN SAMUEL B [US] ET AL) 12 August 1986 (1986-08-12) cited in the application column 5, line 64 - column 7, line 9</td>
<td>1-15</td>
</tr>
</tbody>
</table>

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

### X
See patent family annex.

<table>
<thead>
<tr>
<th>*</th>
<th>*</th>
<th>*</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;A&quot; document defining the general state of the art which is not considered to be of particular relevance</td>
<td>&quot;A&quot; document defining the general state of the art which is not considered to be of particular relevance</td>
<td>&quot;A&quot; document defining the general state of the art which is not considered to be of particular relevance</td>
</tr>
<tr>
<td>&quot;E&quot; earlier application or patent but published on or after the international filing date</td>
<td>&quot;E&quot; earlier application or patent but published on or after the international filing date</td>
<td>&quot;E&quot; earlier application or patent but published on or after the international filing date</td>
</tr>
<tr>
<td>&quot;L&quot; 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)</td>
<td>&quot;L&quot; 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)</td>
<td>&quot;L&quot; 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)</td>
</tr>
<tr>
<td>&quot;O&quot; document referring to an oral disclosure, use, exhibition or other means</td>
<td>&quot;O&quot; document referring to an oral disclosure, use, exhibition or other means</td>
<td>&quot;O&quot; document referring to an oral disclosure, use, exhibition or other means</td>
</tr>
<tr>
<td>&quot;P&quot; document published prior to the international filing date but later than the priority date claimed</td>
<td>&quot;P&quot; document published prior to the international filing date but later than the priority date claimed</td>
<td>&quot;P&quot; document published prior to the international filing date but later than the priority date claimed</td>
</tr>
<tr>
<td>&quot;*&quot; 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</td>
<td>&quot;*&quot; 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</td>
<td>&quot;*&quot; 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</td>
</tr>
<tr>
<td>&quot;*&quot; 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</td>
<td>&quot;*&quot; 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</td>
<td>&quot;*&quot; 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</td>
</tr>
<tr>
<td>&quot;*&quot; 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</td>
<td>&quot;*&quot; 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</td>
<td>&quot;*&quot; 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</td>
</tr>
<tr>
<td>&quot;*&quot; document member of the same patent family</td>
<td>&quot;*&quot; document member of the same patent family</td>
<td>&quot;*&quot; document member of the same patent family</td>
</tr>
</tbody>
</table>

**Date of the actual completion of the international search:** 21 October 2014

**Date of mailing of the international search report:** 28/10/2014

**Name and mailing address of the ISA/ European Patent Office, P.B. 5618 Patentian 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax. (+31-70) 340-3016**

Perrone Dunet, S

Authorized officer
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>US 4605554 A</td>
<td>12-08-1986</td>
<td>NONE</td>
</tr>
<tr>
<td>WO 0152618 A2</td>
<td>26-07-2001</td>
<td></td>
</tr>
<tr>
<td>AU 3447301 A</td>
<td>31-07-2001</td>
<td></td>
</tr>
<tr>
<td>BR 0107692 A</td>
<td>15-10-2002</td>
<td></td>
</tr>
<tr>
<td>CA 2396953 A1</td>
<td>26-07-2001</td>
<td></td>
</tr>
<tr>
<td>DE 60109579 D1</td>
<td>28-04-2005</td>
<td></td>
</tr>
<tr>
<td>DE 60109579 T2</td>
<td>01-09-2005</td>
<td></td>
</tr>
<tr>
<td>EP 1252094 A2</td>
<td>30-10-2002</td>
<td></td>
</tr>
<tr>
<td>ES 2240409 T3</td>
<td>16-10-2005</td>
<td></td>
</tr>
<tr>
<td>JP 4879434 B2</td>
<td>22-02-2012</td>
<td></td>
</tr>
<tr>
<td>JP 2003520177 A</td>
<td>02-07-2003</td>
<td></td>
</tr>
<tr>
<td>US 6579929 B1</td>
<td>17-06-2003</td>
<td></td>
</tr>
<tr>
<td>WO 0152618 A2</td>
<td>26-07-2001</td>
<td></td>
</tr>
<tr>
<td>EP 1591490 A2</td>
<td>02-11-2005</td>
<td></td>
</tr>
<tr>
<td>AU 2005201697 A1</td>
<td>10-11-2005</td>
<td></td>
</tr>
<tr>
<td>AU 2010224410 A1</td>
<td>14-10-2010</td>
<td></td>
</tr>
<tr>
<td>CA 2505084 A1</td>
<td>27-10-2005</td>
<td></td>
</tr>
<tr>
<td>EP 1591490 A2</td>
<td>02-11-2005</td>
<td></td>
</tr>
<tr>
<td>EP 1900780 A1</td>
<td>19-03-2008</td>
<td></td>
</tr>
<tr>
<td>EP 2284224 A1</td>
<td>16-02-2011</td>
<td></td>
</tr>
<tr>
<td>JP 2005314791 A</td>
<td>10-11-2005</td>
<td></td>
</tr>
<tr>
<td>KR 20060056219 A</td>
<td>24-05-2006</td>
<td></td>
</tr>
<tr>
<td>US 2005239921 A1</td>
<td>27-10-2005</td>
<td></td>
</tr>
<tr>
<td>US 2008280142 A1</td>
<td>13-11-2008</td>
<td></td>
</tr>
<tr>
<td>US 2010324186 A1</td>
<td>23-12-2010</td>
<td></td>
</tr>
</tbody>
</table>