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(71) **Applicant** (for all designated States except AE, AG, AU, BB, BH, BN, BW, BZ, CA, CY, EG, GB, GD, GH, GM, IE, IL, IN, JO, KE, KN, KW, LC, LK, LS, MT, MW, MY, NA, NG, NZ, OM, PG, QA, RW, SA, SC, SD, SG, SL, SZ, TT, TZ, UG, US, VC, ZA, ZM, ZW): **UNILEVER N.V.** [NL/NL]; Weena 455, 3013 AL Rotterdam (NL).

(71) **Applicant** (for AE, AG, AU, BB, BH, BN, BW, BZ, CA, CY, EG, GB, GD, GH, GM, IE, IL, IN, JO, KE, KN, KW, LC, LK, LS, MT, MW, MY, NA, NG, NZ, OM, PG, QA, RW, SA, SC, SD, SG, SL, SZ, TT, TZ, UG, VC, ZA, ZM, ZW only): **UNILEVER PLC** [GB/GB]; Unilever House, 100 Victoria Embankment, London Greater London EC4Y 0DY (GB).

(71) **Applicant** (for US only): **CONOPCO, INC., D/B/A UNILEVER** [US/US]; 700 Sylvan Avenue (A4), Englewood Cliffs, New Jersey 07632 (US).

(72) **Inventors**: **LI, Xiaoke**; Unilever (China) Investing Company Ltd Shanghai Branch, No. 66 Linxin Road, Linkong Economic Development Zone, Shanghai, 200335 (CN). **LIU, Renjiang**; Unilever (China) Investing Company Ltd Shanghai Branch, No. 66 Linxin Road, Linkong Economic Development Zone, Shanghai, 200335 (CN). **LIU, Weining**; Unilever (China) Investing Company Ltd Shanghai Branch, No. 66 Linxin Road, Linkong Economic Development Zone, Shanghai, 200335 (CN). **SUN, Yuekui**; Unilever (China) Investing Company Ltd Shanghai Branch, No. 66 Linxin Road, Linkong Economic Development Zone, Shanghai, 200335 (CN). **ZHU, Shugi**; No.6, Lane 200 Xiangnan Road Pudong New District, Shanghai, 201203 (CN).

(74) **Agent**: **WHALEY, Christopher**; Unilever Patent Group, Bronland 14, 6708 WH Wageningen (NL).

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(54) **Title**: AN ANTIPERSPIRANT COMPOSITION COMPRISING AMORPHOUS ZIRCONIA

(57) **Abstract**: The present invention is in the field of antiperspirant compositions, in particular, compositions comprising antiperspirant actives. Disclosed is an antiperspirant composition having pH from 2 to 5 comprising: (i) amorphous zirconia; and (ii) a cosmetically acceptable carrier, wherein the amorphous zirconia is in the form of colloidal particles.



AN ANTIPERSPIRANT COMPOSITION COMPRISING AMORPHOUS ZIRCONIA

Field of the invention

The present invention is in the field of antiperspirant compositions.

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Background of the invention

The present invention relates to compositions, such as those that contain antiperspirant actives. These actives are added to compositions to reduce perspiration upon topical application to the body, particularly to the underarm regions of the human body viz. the axilla and sometimes even on the upper part of the body near the chest.

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Usually, conventional antiperspirant actives are salts of metals having an astringent effect, such as the salts of aluminum and/or zirconium. Since antiperspirants are used regularly, and have been used for decades, there is an ever increasing need to develop alternative antiperspirant actives which are equally efficacious.

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US20060286051 A1 (Catalysts & Chemicals Industries, 2006) discloses an antibacterial deodorant based on inorganic particles comprising a metal composition and an inorganic oxide other than the composition. The inorganic oxide includes titanium oxide and silica and/or zirconia, and the titanium oxide is crystalline titanium oxide.

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US6251412 B (L'Oreal) discloses an antiperspirant composition which comprises zirconium oxide in the form of a pigment. Such zirconium oxide is crystalline in nature.

25 Summary of the invention

The present inventors have found that colloidal particles of zirconia which are amorphous in nature, are stable at lower pH, i.e. from 2 to 5. In addition to being stable, the particles are capable of forming a gel when they contact with aqueous saline media, which is equivalent to perspiration or sweat. The gel can partially or fully block sweat ducts in a non-permanent manner and inhibit further sweating or perspiration. Therefore, the particles can be used as actives in antiperspirant compositions, either by themselves or in combination with other conventional actives like compounds of Aluminum. Their use

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in combination with other conventional actives could provide a useful technical route to reduce the amount of aluminum in such compositions.

5 In accordance with a first aspect is disclosed an antiperspirant composition having pH from 2 to 5 comprising:

- (i) amorphous zirconia; and
- (ii) a cosmetically acceptable carrier,

wherein the amorphous zirconia is in form of colloidal particles.

10 In accordance with a second aspect is disclosed a method of reducing perspiration comprising a step of topical application of the composition of the first aspect.

In accordance with a third aspect is disclosed use of the composition of the first aspect for reduction of bodily perspiration.

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All other aspects of the present invention will more readily become apparent upon considering the detailed description and examples which follow.

20 Except in the examples, or where otherwise explicitly indicated, all numbers in this description indicating amounts of material or conditions of reaction, physical properties of materials and/or use may optionally be understood as modified by the word "about".

All amounts are by weight of the antiperspirant composition, unless otherwise specified.

25 It should be noted that in specifying any ranges of values, any particular upper value can be associated with any particular lower value.

30 For the avoidance of doubt, the word "comprising" is intended to mean "including" but not necessarily "consisting of" or "composed of". In other words, the listed steps or options need not be exhaustive.

The disclosure of the invention as found herein is to be considered to cover all embodiments as found in the claims as being multiply dependent upon each other

irrespective of the fact that claims may be found without multiple dependency or redundancy.

Where a feature is disclosed with respect to a particular aspect of the invention (for example a composition of the invention), such disclosure is also to be considered to apply to any other aspect of the invention (for example a method of the invention) *mutatis mutandis*.

Detailed description of the invention

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By "An antiperspirant Composition" as used herein, is meant to include a composition for topical application to the skin of mammals, especially humans. Such a composition is preferably of the leave-on type. By a leave-on composition is meant a composition that is applied to the desired skin surface and left on for a minute to 24 hours after which it may be wiped or rinsed off with water, usually during the regular course of personal washing. The composition may also be formulated into a product which is applied to a human body for improving the appearance, cleansing, odor control or general aesthetics. The composition of the present invention can be in the form of a liquid, lotion, cream, foam, scrub, gel or stick form and may be delivered through a roll-on device or using a propellant containing aerosol can. It is especially useful for delivering low pH compositions to the axilla of an individual for antiperspirant benefits. "Skin" as used herein is meant to include skin on any part of the body (e.g., neck, chest, back, arms, underarms, hands, legs, buttocks and scalp) especially the underarms.

25 Amorphous zirconia in form of colloidal particles

Antiperspirant compositions in accordance with this invention comprise amorphous zirconia which is in form of colloid particles.

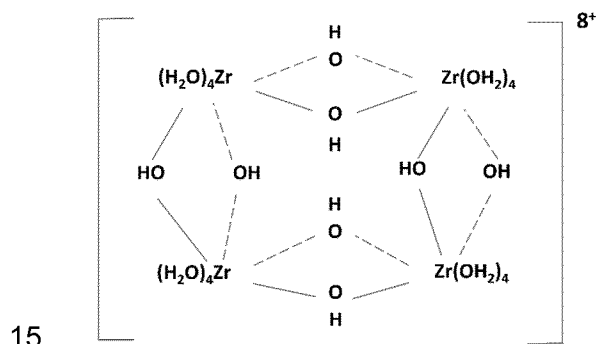
30 Amorphous materials, different from the crystalline materials, lack the long-range order that is characteristic of a crystal. Amorphous materials have an internal structure made of interconnected structural blocks. Whether a material is liquid or solid depends primarily on the connectivity between its elementary building blocks so that solids are

characterized by a high degree of connectivity whereas structural blocks in fluids have lower connectivity.

Colloidal refers to items of a small size that are floating in a medium of one of three substances: a solid, a liquid, or a gas. Colloidal particles are microscopic solid particles suspended in a fluid. Unlike a solution, whose solute and solvent constitute only one phase, a colloid has a dispersed phase (the suspended particles) and a continuous phase (the medium of suspension).

Preferably, the amorphous zirconia is a cationic hydroxylated polynuclear zirconium species. More preferably the amorphous zirconia is a zirconia sol..

More preferably, the amorphous zirconia is zirconia sol which comprises ZrO_2 having the following structure:



A preferred amorphous zirconia in form of colloidal particles is available under the name Zirconia Sol from Dalian Snowchemical S&T Co., Ltd. It is dispersed in aqueous medium and is mainly used in the electronics industry.

20

It is particularly preferred that particle size of the colloidal particles is 1 to 200 nm, more preferably 1 to 50 nm, and most preferably 5 to 25 nm. Without wishing to be bound by theory it is believed that colloidal particles with smaller size are more stable and able to diffuse into sweat ducts which have the size of around 5 to 50 microns.

25

It is preferred that the antiperspirant composition comprises from 1 to 30 wt%, and more preferably from 5 to 30 wt%, and most preferably from 8 to 25 wt% colloidal particles of amorphous zirconia, based on total weight of the composition.

5 Antiperspirant compositions in accordance with this invention may advantageously comprise an additional antiperspirant active. Whilst this could be a conventional antiperspirant salt comprising Al and/or other forms of Zr, such as aluminum chlorohydrate or aluminum-zirconium chlorohydrate optionally complexed with glycine, it is preferred that if any additional antiperspirant active is comprised in the compositions
10 of the invention, is not of this type.

Stabilizer

It is essential to have the composition formulated and delivered at a low pH in the range of 2 to 5. However, preferably the pH of the compositions of the invention is 3 to 5. More
15 preferably the pH is 3.5 to 4.5. Without wishing to be bound by theory it is believed that under the preferred and the more preferred pH, the compositions of the invention are more stable and more skin-friendly. When pH of the compositions of the invention is 3 to 5, the compositions comprise a stabilizer, other than an acid or a strong alkali, to maintain the pH from 3 to 5.

20

Without further wishing to be bound by theory it is believed that the stabilizer acts as a chelator to control or regulate the stability of the colloidal particles and to yield a stabler sol. The chelating ability is ideally neither too weak (to stabilize the composition when stored) nor too strong (to form a gel when the pH is further increased).

25

The stabilizer in accordance with this invention is preferably a weak base and / or a buffer, other than a strong alkali.

It is preferred that the weak base is ammonia, basic amino acids, alkaline earth
30 hydroxides, carbonates and bicarbonates, alkanolamines, for example amino-2-methyl-1-propanol, monoethanolamine, triethanolamine, diethanolamine and triisopropanolamine, alkali metal metasilicates, urea, morpholine, N-methylglucamine or imidazole.

It is more preferred that the stabilizer is a water-soluble silicate, citrate or acetate. It is particularly preferred that the stabilizer is sodium silicate, potassium silicate, sodium citrate, potassium citrate, strontium acetate, ammonium acetate, magnesium acetate or calcium acetate.

5

When the stabilizer is a buffer, it is preferred that the buffer is selected from carbonic acid bicarbonate buffer, carbonic acid silicate buffer, acetic acid acetate buffer, ammonia buffer, citric acid or citrate buffer, buffer based on tris (hydroxymethyl) aminomethane, buffer based on 4- (2-hydroxyethyl) -1-piperazineethanesulfonic acid, 4- (2-hydroxyethyl)
10 -piperazine-1-propanesulfonic acid-based buffer, 2- (N-morpholino) ethanesulfonic acid-based buffer and barbital acetate buffer.

Without wishing to be bound by theory the inventors believe that there are two features necessary to ensure the benefits afforded by the present invention. It is essential to have
15 the composition formulated and delivered at a lower pH in the range of 2 to 5 preferably 3 to 5 in order for the formulation to be stable, effective and safer. This is ensured by including therein a stabilizer, when the pH is from 3 to 5, so that the desired pH of the composition is quickly attained when the composition is formulated and further when the composition is diluted in the presence of sweat. Once inside the sweat glands, it is
20 believed that pH of the surrounding medium is about 5 to 7 because at this stage the composition comes in contact with sweat. This contact induces the growth of colloidal particles of the amorphous zirconia to thereby form a gel-network which partially or fully and in a non-permanent manner, clogs the sweat ducts to provide antiperspirant benefits.

25 Other components commonly included in conventional antiperspirant compositions may also be incorporated in the compositions of the present invention. Such components include skin care agents such emollients, humectants and skin barrier promoters; skin appearance modifiers such as skin lightening agents and skin smoothing agents; anti-microbial agents, in particular organic anti-microbial agents, and preservatives.

30

The antiperspirant compositions of the invention could be applied cosmetically and topically to the skin, broadly speaking, by one of two methods. Different consumers prefer one method or the other. In one method, sometimes called a contact method, the

composition is wiped across the surface of the skin, depositing a fraction of the composition as it passes. In the second method, sometimes called the non-contact method, the composition is sprayed from a dispenser held proximate to the skin, often in an area of about 10 to 20 cm². The spray can be developed by mechanical means of
5 generating pressure on the contents of a dispenser, such as a pump or a squeezable sidewall or by internally generated pressure arising from a fraction of a liquefied propellant volatilizing, the dispenser commonly being called an aerosol.

There are broadly speaking two classes of contact compositions, one of which is liquid
10 and usually applied using a roll-on dispenser or possibly absorbed into or onto a wipe, and in the second of which the antiperspirant active is distributed within a carrier liquid that forms a continuous phase that has been gelled. In one variation, the carrier fluid comprises a solvent for the antiperspirant and in a second variation, the antiperspirant remains a particulate solid that is suspended in an oil, usually a blend of oils.

15 An antiperspirant composition as claimed in any of claims 1 to 7 wherein said carrier is anhydrous or aqueous.

An antiperspirant composition as claimed in claim 8 wherein when said carrier is
20 anhydrous, it comprises a silicone compound, a volatile alcohol or a wax.

An antiperspirant composition as claimed in claim 8 or 9 wherein said composition is in the form of a cream, a spray, a firm solid, a soft solid or is an emulsion packaged in a roll-on applicator.

25 An antiperspirant composition as claimed in any of claims 1 to 9 wherein said composition comprises a propellant and is in the form of an aerosol

Stick compositions

30 Many different materials have been proposed as gellants for a continuous oil phase, including waxes, small molecule gelling agents and polymers. They each have their advantages and of them, one of the most popular class of gellants is waxes, partly at least due to their ready availability and ease of processing, including in particular linear

fatty alcohol wax gellants. A gelled antiperspirant composition is applied topically to skin by wiping it across and in contact with the skin, thereby depositing on the skin a thin film.

The nature of the film depends to a significant extent on the gellant that is employed.

5 Although wax fatty alcohols have been employed as gellants for many years, and are effective for the purpose of gelling, the resultant product is rather ineffective at improving the visual appearance of skin, and in particular underarm skin, to which the composition has been applied. This problem has been solved by including ameliorating materials for example, di or polyhydric humectants and/or a triglyceride oil.

10

Stick compositions are usually available in the form of a firm solid or a soft solid. Firm solids, as the name indicates, are harder and can be directly applied by way of an applicator, for example, to the underarms. Soft solids also need an applicator which is similar to the firm solids, the difference being that the soft solids are softer and the applicator needs to be designed in order to permit extrusion of the solids through a cap member comprising plurality of orifices and the extruded composition can then be applied to the underarms.

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Roll-on

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Liquid compositions that are applicable from a roll-on broadly speaking can be divided into two classes, namely those in which an antiperspirant active is suspended in a hydrophobic carrier, such as a volatile silicone and those in which the antiperspirant active is dissolved in a carrier liquid. The latter has proven to be more popular. There are mainly two sorts of dissolving carrier liquid, namely carriers that are predominantly alcoholic, which is to say the greater part of the dissolving carrier fluid comprises ethanol and the second class in which the carrier liquid is mainly water. The former was very popular because ethanol is a mild bactericide in its own right, but its popularity waned because it stings, especially if the surface onto which the composition has been applied has been damaged or cut, such as can easily arise during shaving or other depilatory actions.

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30

The second class of formulations that is an alternative to alcoholic formulations comprise a dispersion of water-insoluble or very poorly water-soluble ingredients in an aqueous

solution of the antiperspirant. Herein, such compositions will be called emulsions. Antiperspirant roll-on emulsions commonly comprise one or more emulsifiers to maintain a distribution of the water-soluble ingredients.

5 Aerosol compositions

The antiperspirant composition may be delivered through an aerosol composition which comprises a propellant in addition to the other ingredients described hereinabove. Commonly, the propellant is employed in a weight ratio to the base formulation of from 95:5 to 5:95. Depending on the propellant, in such aerosol compositions the ratio of
10 propellant to base formulation is normally at least 20:80, generally at least 30:70, particularly at least 40:60, and in many formulations, the weight ratio is from 90:10 to 50:50. A ratio range of from 70:30 to 90:10 is sometimes preferred.

Propellants herein generally are one of three classes; i) low boiling point gasses liquified
15 by compression, ii) volatile ethers and iii) compressed non-oxidising gases.

Class i) is conveniently a low boiling point material, typically boiling below -5°C , and often below -15°C , and in particular, alkanes and/or halogenated hydrocarbons. This class of propellant is usually liquefied at the pressure in the aerosol canister and
20 evaporates to generate the pressure to expel the composition out of the canister. Examples of suitable alkanes include particularly propane, butane or isobutane. The second class of propellant comprises a very volatile ether of which the most widely employed ether hitherto is dimethyl ether. This propellant can advantageously be employed at relatively low weight ratio of propellant to base formulation, for example to
25 as low as 5:95. It can also be employed in admixture with, for example, compressible/liquefiable alkane gasses. The third class of propellant comprises compressed non-oxidising gasses, and in particular carbon dioxide or nitrogen. Inert gases like neon are a theoretical alternative.

30 The composition of the invention comprises a topically acceptable carrier. When the composition of the invention is in the form of a roll-on, a cream, a spray, or a firm solid or a soft solid, the topically acceptable carrier comprises an anhydrous carrier or an aqueous carrier. The anhydrous carrier in such cases may comprise a silicone

compound, low boiling alcohol or a wax. When the composition comprises a propellant, it is delivered as an aerosol.

The composition of the present invention can comprise a wide range of other optional components. The CTFA Personal Care Ingredient Handbook, Second Edition, 1992, which is incorporated by reference herein in its entirety, describes a wide variety of non-limiting personal care and pharmaceutical ingredients commonly used in the skin care industry, which are suitable for use in the compositions of the present invention. Examples include: antioxidants, binders, biological additives, buffering agents, colorants, thickeners, polymers, astringents, fragrance, conditioners, exfoliating agents, pH adjusters, other than the ones already discussed earlier, preservatives, natural extracts, essential oils, skin sensates, skin soothing agents, and skin healing agents.

A preservative is a preferred additional component in compositions of the invention. A preservative serves to reduce or eliminate microbial contamination of compositions of the invention. Preservatives are typically employed at a total level of from 0.05 to 3%, preferably at from 0.1 to 2% and most preferably at from 0.4 to 1%.

Suitable preservatives for use with the present invention include 2-phenoxyethanol, iodopropynyl butylcarbamate, C₁-C₃ alkyl parabens, sodium benzoate, caprylyl glycol and EDTA. Particularly preferred preservatives are 2-phenoxyethanol, iodopropynyl butylcarbamate, sodium benzoate, caprylyl glycol and EDTA and especially preferred are 2-phenoxyethanol and iodopropynyl butylcarbamate.

A preferred additional component of compositions of the invention is a fragrance. Suitable materials include conventional perfumes, such as perfume oils and also include so-called deo-perfumes, as described in EP 545,556 and other publications. Levels of incorporation are preferably up to 4% by weight, particularly from 0.1% to 2% by weight, and especially from 0.7% to 1.7% by weight.

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An antimicrobial deodorant active is a preferred an additional component in compositions of the invention. Such components serve to reduce or eliminate body odour by reducing

or otherwise impeding the function of microbes on the skin of the body responsible for malodour generation.

The antimicrobial deodorant active may also be a preservative for the composition.

5

When employed, the anti-microbial deodorant agent is typically incorporated into the composition at from 0.01% to 3% and particularly at from 0.03% to 0.5%.

Preferred anti-microbial deodorant agents have a minimum inhibitory concentration (MIC) of 1 mg.ml⁻¹ or less, particularly 200 µg.ml⁻¹ or less, and especially 100 µg.ml⁻¹ or less. The MIC of an anti-microbial agent is the minimum concentration of the agent required to significantly inhibit microbial growth. Inhibition is considered "significant" if an 80% or greater reduction in the growth of an inoculum of *Staphylococcus epidermidis* is observed, relative to a control medium without an anti-microbial agent, over a period of 16 to 24 hours at 37°C. Details of suitable methods for determining MICs can be found in "Antimicrobial Agents and Susceptibility Testing", C.Thornsberry, (in "Manual of Clinical Microbiology", 5th Edition, Ed. A. Balows *et al*, American Society for Microbiology, Washington D.C., 1991). A particularly suitable method is the Macrobrotth Dilution Method as described in Chapter 110 of above publication (pp. 1101-1111) by D. F. Sahm and J. A. Washington II. MICs of anti-microbials suitable for inclusion in the compositions of the invention are triclosan: 0.01-10 µg.ml⁻¹ (J.Regos *et al.*, Dermatologica (1979), 158: 72-79) and farnesol: ca. 25 µg.ml⁻¹ (K. Sawano, T. Sato, and R. Hattori, Proceedings of the 17th IFSCC International Conference, Yokahama (1992) p.210-232). By contrast ethanol and similar alkanols have MICs of greater than 1 mg.ml⁻¹.

25

Suitable organic anti-microbials are bactericides, for example quaternary ammonium compounds, like cetyltrimethylammonium salts; chlorhexidine and salts thereof; and diglycerol monocaprates, diglycerol monolaurate, glycerol monolaurate, and similar materials, as described in "Deodorant Ingredients", S.A.Makin and M.R.Lowry, in "Antiperspirants and Deodorants", Ed. K. Laden (1999, Marcel Dekker, New York). More preferred anti-microbials for use in the compositions of the invention are polyhexamethylene biguanide salts (also known as polyaminopropyl biguanide salts), an example being Cosmocil CQTM available from Zeneca PLC, preferably used at up to 1%

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and more preferably at 0.03% to 0.3% by weight; 2',4,4'-trichloro,2-hydroxy-diphenyl ether (triclosan), preferably used at up to 1% by weight of the composition and more preferably at 0.05-0.3%; and 3,7,11-trimethyldodeca-2,6,10-trienol (farnesol), preferably used at up to 1% by weight of the composition and more preferably at up to 0.5%.

5

Other suitable organic antimicrobial agents are transition metal chelators, as described in WO01/52805, for example. Transitional metal chelators having a binding coefficient for iron (III) of greater than 10^{26} , for example diethylenetriaminepentaacetic acid and salts thereof are preferred.

10

The present invention also provides for a method of reducing perspiration comprising a step of topical application of the composition of the first aspect. Particularly, the present invention provides for a method wherein the composition of the first aspect is applied on the underarms. The present invention also provides for a method wherein the composition of the first aspect partially or fully blocks sweat ducts in a non-permanent manner. The method is preferably non-therapeutic. By non-therapeutic is meant that the method is cosmetic in nature.

15

The invention also provides for use of the composition of the first aspect for reduction of bodily perspiration. The use is preferably non-therapeutic in nature, more preferably cosmetic in nature. Particularly, the present invention provides for use of the composition of the first aspect for partially or fully blocking sweat ducts in a non-permanent manner.

20

The invention also provides for use of colloidal particles of amorphous zirconia as an antiperspirant active.

25

The invention will now be demonstrated with the help of the following non-limiting examples.

Examples

30

Materials

Table -1

5

Trade/Chemical name	Supplier	Particle size	Amount of ZrO ₂ (wt%)	Form
Zirconia sol	Dalian Snowchemical S&T Co., Ltd, China	5 to 25 nm	27.3 (aqueous dispersion)	Amorphous
Zirconia powder	Aldrich	about 5 microns	>95%	Crystalline

Example 1: Gelation of compositions triggered by pH

10 The following compositions were prepared as given in Table -2.

Table 2

Reference No.	ZrO ₂ (wt%)	Water	pH of the final compositions
1	27.3 (ZrO ₂ sol in water dispersion)	Balance to 100 wt%	2.6 to 2.8
A	20 (ZrO ₂ powder)	Balance to 100 wt%	2.6 (adjusted by hydrochloric acid)
B	30 (ZrO ₂ powder)	Balance to 100 wt%	2.6 (adjusted by hydrochloric acid)

15 The ability of the above compositions to gel was tested by the following procedure:

10 ml of the concerned composition was taken in a beaker and an aqueous solution of potassium hydroxide was added dropwise under stirring, to adjust/increase the pH of the medium. The appearance of each sample was checked visually and recorded at various pH as the pH increased gradually. The samples were graded as either Transparent (T), Cloudy (C) or Gelation (G). The data on the appearance of the samples is summarized in Table -3 below:

20

Table -3

Reference no.	pH=2.6 to 2.8	pH = 4 (with KOH)	pH = 7 (with KOH)
1	T	C	G
A	C	C	C
B	C	C	C

The data in Table -3 above indicates that composition as per the invention (Reference No. 1) was stable (transparent) at pH 2.6 to 2.8 and its gelation was triggered by an increase in the pH of the medium. It indicates the ability of the composition as per the invention to form a gel upon contact with sweat. The other compositions A and B were comparatively unstable at pH 2.6 to 2.8 (as they were cloudy) and they continued to remain cloudy under higher pH. These compositions did not gel.

Example 2: Gelation of compositions with model sweat

An experiment was arranged using the device as disclosed in the International Application PCT/EP2017/080728 (Unilever).

The device has a 20X20 μm channel. The surface intension of fluid is strong and prevents its flowing in the capillary. Therefore, before use, the channel was filled with model ionic sweat (pH 6.9), comprising chloride salts, lactic acid, urea and water. The composition according to the invention, (Reference No. 1) was placed at one end of the channel. When the model ionic sweat comes in contact with the composition, in view of the change in pH, the composition is believed to turn into something like a gel or precipitate, thereby effectively fully or partially blocking the channel.

The pore blocking efficacy was investigated by measuring the flow rate of the model ionic sweat through the capillary. This flow rate is believed to be reduced by the presence of the gel or the precipitate. The model ionic sweat was pumped into the channel from the other end of the channel by using pressure pump with flow-rate monitor and hydraulic pressure control (MFCStm-EZ, FLUIGENT)

The flow rate of the model ionic sweat was reduced to zero after 30 minutes, which indicated the formation of a gel which blocked the channel.

Example 3: Effect of stabilizers on stability and gelation

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It is desirable that the compositions are stable under storage conditions, but form a gel soon after they contact with sweat, which renders them fit for use as antiperspirants.

The following compositions as given in Table -4 were prepared

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Table -4

Reference No.	Amorphous ZrO ₂ (wt%)	Stabilizer (wt%)	Water	pH
2	23.8	sodium silicate 1.60	To 100 wt%	3.6
3	26.4	calcium acetate 3.4	To 100 wt%	3.6
4	26	strontium acetate 4.8	To 100 wt%	3.6
5	26.6	sodium acetate 2.5	To 100 wt%	3.6

The following procedure was used to assess the stability of the compositions:

15

Few samples of each composition were transferred to transparent plastic cups which were thereafter stored at 40°C for four weeks. The appearance of each sample in its respective cup was checked visually and recorded periodically throughout the period. The samples were graded as either Transparent (T), Cloudy (C) or Gelation (G). The data about appearance of the samples is summarized in Table -5 below:

20

Table -5

Reference No.	0 week	1 week	2 weeks	3 weeks	4 weeks
2	T	T	T	T	T
3	T	T	T	T	T
4	T	T	T	T	T
5	T	T	T	T	T

The data in Table -5 indicates that compositions as per preferred aspect of the invention
 5 (Reference No. 2 to 5) were stable (on storage) for up to and including 4 weeks.

The gelation behaviour of above compositions was tested by following the procedure described earlier.

10 The data is summarized in Table -6 below:

Table -6

Reference No.	pH=3.6	pH>6 (with NaHCO ₃)
2	T	G
3	T	G
4	T	G
5	T	G

15

The data in Table -6 above indicates that compositions as per the preferred aspect of the invention (Reference No. 2 to 5) are transparent on application and form a gel when the pH is increased beyond 6.

20 Example 4: Dosage of colloidal particles of amorphous zirconia in compositions

Table -7 lists compositions comprising varying dosage of colloidal particles of amorphous zirconia and stabilizers.

Table -7

Reference No.	Amorphous ZrO ₂ (wt%)	Stabilizer (wt%)		Water	pH
2	23.8	sodium silicate	1.60	To 100	3.6
6	11.9		0.80	To 100	3.6
7	7.9		0.53	To 100	3.6
3	26.4	calcium acetate	3.38	To 100	3.6
8	13.2		1.69	To 100	3.6
9	8.8		1.13	To 100	3.6

5 Gelation behaviour of above compositions was tested by following the procedure described earlier.

The data on the appearance of the samples is summarized in Table -8 below:

Table -8

10

Reference No.	pH= 3.6	pH>6 (with NaHCO ₃)
2	T	G
6	T	G
7	T	G
3	T	G
8	T	G
9	T	G

15 The data in Table -8 above indicates that all compositions as per preferred aspect of the invention with various dosage of colloidal particles of amorphous zirconia and stabilizers (Examples 2 to 3, and 6 to 9) are transparent on application but form gel when the pH is increased beyond 6.

Claims

1. An antiperspirant composition having pH from 2 to 5 comprising:
 - (i) amorphous zirconia; and
 - (ii) a cosmetically acceptable carrier,wherein the amorphous zirconia is in the form of colloidal particles.
2. An antiperspirant composition as claimed in claim 1 wherein said pH is from 3 to 5.
3. An antiperspirant composition as claimed in claim 2 comprising a stabilizer to maintain said pH from 3 to 5.
4. An antiperspirant composition as claimed in claim 3 wherein said stabilizer is a water-soluble silicate, citrate or acetate.
5. An antiperspirant composition as claimed in any of claims 1 to 4 wherein particle size of said colloidal particles is 1 to 200 nm.
6. An antiperspirant composition as claimed in claim 5 wherein said particle size is 1 to 50 nm.
7. An antiperspirant composition as claimed in any of claims 1 to 6 comprising 1 to 30 wt% of said amorphous zirconia.
8. An antiperspirant composition as claimed in any of claims 1 to 7 wherein said carrier is anhydrous or aqueous.
9. An antiperspirant composition as claimed in any of claims 1 to 8 wherein said composition comprises a propellant and is in the form of an aerosol.
10. A method of reducing perspiration comprising a step of topical application of a composition as claimed in any of claims 1 to 9.

11. A method as claimed in claim 10 wherein said composition is applied on the underarms.
12. A method as claimed in claim 10 or 11 wherein, upon application, said composition partially or fully blocks sweat ducts in a non-permanent manner.
13. Use of composition as claimed in any of claims 1 to 9 for reduction of bodily perspiration.
14. Use as claimed in claim 13 wherein said use is non-therapeutic in nature.
15. Use as claimed in claim 13 or 14 wherein said use partially or fully blocks sweat ducts in a non-permanent manner.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/065983

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61K8/02 A61K8/28 A61Q15/00
ADD.

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 practicable, search terms used)

EPO-Internal, BIOSIS, CHEM ABS Data, EMBASE, FSTA, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2018/022615 A1 (SPONCHIA GABRIELE [IT] ET AL) 25 January 2018 (2018-01-25) paragraphs [0001], [0002], [0030] -----	1-15
A	JP S61 194012 A (LION CORP) 28 August 1986 (1986-08-28) claims 1-23 -----	1-15
A	D. S. S. PADOVINI ET AL: "Facile synthesis and characterization of ZrO ₂ nanoparticles prepared by the AOP/hydrothermal route", RSC ADV., vol. 4, no. 73, 1 September 2014 (2014-09-01), page 38484, XP055544310, DOI: 10.1039/C4RA04861J the whole document ----- -/-	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search

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Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Hörtner, Michael

INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A,P	WO 2018/141032 A1 (OREAL [FR]; BARROSO PEDRO TUPINAMBA WERNECK [BR]) 9 August 2018 (2018-08-09) examples 3-6 -----	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2019/065983

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