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(54) **Title:** AN ANTIPERSPIRANT COMPOSITION COMPRISING POLYMERIC MATERIAL

(57) **Abstract:** The present invention is in the field of antiperspirant compositions, in particular, compositions comprising antiperspirant actives. Disclosed is an antiperspirant composition comprising no aluminium or zirconium, said composition comprising: (i) an aqueous dispersion of a non-thermoplastic polymeric material of particle size 5 to 5000 nm; (ii) a surfactant; and (iii) an aqueous cosmetically acceptable carrier; wherein said non-thermoplastic polymeric material absorbs no more than 1g water per gram of its own weight at room temperature (25°C); and wherein said polymeric material is an acrylate copolymer, a polyurethane polymer or a copolymer comprising silicone and acrylate.

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AN ANTIPERSPIRANT COMPOSITION COMPRISING POLYMERIC MATERIAL

Field of the invention

The present invention is in the field of antiperspirant compositions.

Background of the invention

The present invention relates to compositions 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. Usually, the antiperspirant actives are salts of metals having an astringent effect, such as the salts of aluminium. Since antiperspirants are used regularly, and have been used for decades, the perceived risk associated with their use is steadily rising. Therefore, there is an ever-increasing need to develop alternative antiperspirant actives which are efficacious.

WO2013131107 A1 (Amcol International Corporation, 2013) discloses a composition containing polymeric microparticles that effectively reduce perspiration to control underarm wetness and malodor formation in the absence of aluminium/zirconium antiperspirant compounds. It is believed that microparticles reduce the perspiration in part by absorbing a portion of the perspiration and also by helping facilitate and/or expedite the evaporation of perspiration. Such polymer microparticles absorb significant amount of water and oil.

US2009220555 A1 (Coty B.V., 2009) discloses a sweat-absorbing cosmetic product comprising a sweat absorbing complex comprising a water-absorbing component which is a polymer, a surface-active agent, an electrolyte and a solvent.

WO05044213 A1 (Colgate Palmolive, 2005) discloses an underarm antiperspirant composition comprising a stick or soft solid suspension product comprising a superabsorbent polymer which absorbs at least 25 wt% water (relative to its own weight), a volatile silicone, and a selected gelling agent to reduce wetness under the arm.

EP1561455 A1 (Kao Corporation, 2005) discloses an emulsified cosmetic composition comprising surface-hydrophobated water-absorbing polymer particles as antiperspirant actives. The amount of water absorbed into the surface-hydrophobated water-absorbing polymer particles is 5 to 100 g/g.

US4743440 A (Unilever, 1988) discloses a personal antiperspirant composition containing a moisture-absorbent polymer instead of or in addition to the usual metal salt. Such a polymer is capable of absorbing an amount of moisture at least equal to its own weight after applying the product onto skin.

US6274127 B1 (The Procter & Gamble Company, 2001) discloses anhydrous non-adhesive antiperspirant compositions comprising a water or sweat-reactive monomer as the antiperspirant active, an anhydrous carrier and a polymerization inhibitor. When the composition is applied in the armpits, the moisture (sweat) triggers polymerization of the monomers. Then monomers polymerize to form a film.

US5508024 B1 (International Research and Development Corp., 1996) discloses a topical antiperspirant composition consisting essentially of an effective amount of a non-toxic water-insoluble occlusive film forming antiperspirant polymer in a topically acceptable non-toxic medium. Such film forming polymers are flakes or powders and the film that they form is topical, i.e., on the surface of the skin.

Summary of the invention

The present inventors have found that the polymers that absorb water, merely absorb sweat/perspiration but do little to control or regulate the production of sweat. Therefore, in such cases, it is necessary to rely on conventional antiperspirants and if the antiperspirant is highly efficacious, such as Aluminum Chloride Hydrate (ACH), then the superabsorbent polymers have more or less no role to perform as far as the antiperspirant effect is concerned. In addition, such polymers have the drawback of leaving behind powdery residue on the underarms.

On the other hand, purely surface film-forming agents may not be as effective as conventional antiperspirants because the polymer forms a film on the surface of the skin. Therefore, practically, such compositions almost always need conventional antiperspirants. The technology that relies on polymerization on the skin is also likely to face the same problems.

The present inventors have surprisingly observed that an aqueous dispersion of a non-thermoplastic polymeric material of certain particle size can enter the sweat ducts. Once the particles have entered the ducts and once the aqueous solvent has evaporated to some extent at least, the particles, that were earlier dispersed or emulsified in the medium, are now free to coalesce or bond with each other and form an aggregation/precipitation inside the sweat ducts. The aggregation/precipitation that is formed is then capable of preventing or at least reducing the production of sweat. In this manner, the particles behave much like conventional antiperspirants and block sweat ducts partially or fully in a non-permanent manner. Such particles leave behind, little residue, if at all. Therefore, their use is not associated with the drawbacks faced by superabsorbent polymers. The polymeric material absorbs no more than 1 g water per gram of its own weight, which distinguishes this material from superabsorbent polymers disclosed in the compositions of prior art. On the other hand, the polymeric material is not dissolved or solubilized in the medium but rather the particles are dispersed in the medium which distinguishes them from the conventional film-forming polymers which are in molecular form owing to their high solubility in the medium in which they are applied.

In accordance with a first aspect is disclosed an antiperspirant composition comprising no aluminium or zirconium, said composition comprising:

(i) an aqueous dispersion of a non-thermoplastic polymeric material of particle size 5 to 5000 nm;

(ii) a surfactant; and

(iii) an aqueous cosmetically acceptable carrier;

wherein said non-thermoplastic polymeric material absorbs no more than 1 g water per gram of its own weight at room temperature (25°C);

and wherein said polymeric material is an acrylate copolymer, a polyurethane polymer or a copolymer comprising silicone and acrylate.

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

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

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

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.

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

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

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 one 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. "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.

Particle size:
Where the size of particles is mentioned (other than "primary particle size") this means the number average diameter determined, for example measured by a Malvern Zetasizer Nano ZS.

Water absorbing test procedure:
The polymeric material is dried in an oven under 50°C for 24 hours and then placed in a desiccator to cool. Immediately upon cooling the material is weighed. The material is then emerged in water at room temperature (25°C) for 4 hours or until equilibrium. The material is removed, patted dry with a lint free cloth, and weighed. Water Absorption = (Wet weight - Dry weight)/ Dry weight

<u>Aqueous dispersion of a non-thermoplastic polymeric material</u>

Antiperspirant compositions in accordance with this invention comprise an aqueous dispersion of a non-thermoplastic polymeric material.

Non-thermoplastic polymeric material here means the polymeric material which can form bulk when solvent evaporates, is different from the thermoplastic polymeric material, which can only become pliable or moldable above a specific temperature and solidifies upon cooling.

An aqueous dispersion is a two-phased system that is made up of fine particles that are uniformly distributed throughout water.

The non-thermoplastic polymeric material of the present invention is in the form of aqueous dispersion, and is distinct from the superabsorbent polymers which can absorb and retain extremely large amounts of a liquid (generally water) relative to their own mass which is orders of magnitude greater than their own mass, usually 10X to 50X.

The non-thermoplastic polymeric material of the present invention absorbs no more than 1g water per gram of its own weight, preferably absorbs no more than 0.5 g water per gram of its own weight and most preferably absorbs no more than 0.3 g water per gram of its own weight.

Particle size of the non-thermoplastic polymeric material is 5 to 5000 nm, preferably 15 to 500 nm, and more preferably 15 to 250 nm. Without wishing to be bound by theory it is believed that the non-thermoplastic polymeric material with smaller sizes are more able to diffuse easily into sweat ducts which have the size of around 5 to 50 microns.

It is preferred that the antiperspirant composition comprises from 0.5 to 50 wt%, and more preferably from 2 to 30 wt%, and most preferably from 5 to 20 wt% the non-thermoplastic polymeric material, based on total weight of the composition.

In accordance with this invention, the non-thermoplastic polymeric material is an acrylate copolymer, a polyurethane polymer or a copolymer comprising silicone and acrylate. Preferably, the copolymer comprsing silicone and acrylate is an acrylates/polytrimethylsiloxymethacrylate copolymer. Preferred non-thermoplastic polymeric materials are commercially available as:

- KOBOGUARD® 50N from Kobo (Acrylate copolymer)
- KOBOGUARD® 50A from Kobo (Acrylates/Ethylhexyl Acrylate Copolymer)
- DOWSIL™ FA4103 from Dow Chemicals (Acrylates/Polytrimethylsiloxymethacrylate Copolymer)
- Avalure AC120 from Lubrizol (Acrylate copolymer); and
- Baycusan® C1008 from Covestro (Polyurethane)

Antiperspirant compositions in accordance with this invention may advantageously comprise an additional antiperspirant active. However, the compositions of the present invention comprise no aluminium or zirconium.

Non-aluminum and non-zirconium antiperspirant actives may be present to augment or supplement the antiperspirant activity of the non-thermoplastic polymeric material as disclosed. Non- aluminum or zirconium antiperspirant active is preferably selected from glycerol monolaurate plus isostearyl alcohol, chitosan or a salt thereof with a weight average molecular weight of from 250 to 650 kDa, titanium compound chelated by alkanolamine with an acid and a polyhydric alcohol, or cholic acid derivative selected from a hydroxycholic acid or a salt thereof with a multivalent metal salt.

Surfactant

Without wishing to be bound by theory it is believed that the surfactant acts as an aid to stabilize the non-thermoplastic polymeric material in the composition and assist the diffusion of the non-thermoplastic polymeric material into the sweat duct. Therefore, it is essential to include a surfactant in the compositions of the present invention.

Preferably the surfactant in accordance with this invention is an anionic, amphoteric or non-ionic surfactant.

It is preferred that the surfactant is water-soluble. When the surfactant is nonionic, it is particularly preferred that the HLB value of the surfactant is greater than 10, more preferably greater than 13. It is preferred that the HLB value of the surfactant is less than 18.

It is preferred that the antiperspirant composition comprises from 0.1 to 15 %, and more preferably from 0.3 to 10 wt%, and most preferably from 0.3 to 5 wt% the surfactant, based on total weight of the composition.

Without wishing to be bound by theory the inventors believe that once the polymeric material is inside the sweat ducts, then due to gradual evaporation of the solvent, the aggregation or coalescence of the non-thermoplastic polymeric material is induced to thereby form an aggregation/precipitation which partially or fully, and in a non-permanent manner, clogs or blocks the sweat ducts to provide antiperspirant benefits.

Other ingredients

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 as 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.

The antiperspirant compositions of the invention are 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 cm^2. The spray can be developed by mechanical means of 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 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.

The composition of the invention comprises an aqueous cosmetically acceptable carrier. The term aqueous means that the composition of the invention comprises water as the main carrier or that water forms a major part of the carrier. In such cases, other solvents and ingredients other than water may also be present.

It is preferred that the antiperspirant composition of the invention comprises less than 5% alcoholic solvent where said solvent is ethanol or isopropanol. It is more preferred that the antiperspirant composition of the invention comprises less than 3% alcoholic solvent which is ethanol or isopropanol. It is further preferred that the antiperspirant composition of the invention comprises less than 1% alcoholic solvent which is ethanol or isopropanol. It is believed that the presence of alcoholic solvent as disclosed herein is likely to affect the dispersed or emulsified state of the polymeric material.

It is preferred that the composition of the invention 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.

Further preferably, when said composition is a spray it comprises a propellant and the composition is in the form of an aerosol.

Stick compositions

In one aspect, the antiperspirant compositions of the invention is a stick composition which is usually in the form of an emulsion. Antiperspirant emulsion sticks are solidified compositions characterized as having aqueous and oil phases. Among such antiperspirant emulsion sticks are compositions having a disperse aqueous phase in which is dissolved an antiperspirant active, in usual cases, aluminium, zirconium and/or mixed aluminium/zirconium salts, and a continuous oil phase comprising one or more gelling agents capable of structuring such phase.

Antiperspirant emulsion sticks can be formulated as clear (i.e., translucent or

transparent) or opaque compositions. Translucent or transparent emulsion sticks go on clear and, depending upon their formulation, may remain clear for extended periods of time, reducing the consumer perceived negative of "white marks" associated with deposition of antiperspirant active. 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. 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.

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.

Roll-on

Alternatively, the composition of the invention is a liquid composition, that can be dispensed from a roll-on package. Broadly speaking such compositions could 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 second category 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.

Aerosol compositions

Further alternatively, the antiperspirant composition of the invention is delivered through an aerosol composition which comprises a propellant in addition to the applicable 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 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 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 evaporates to generate the pressure to expel the composition out of the canister. Examples of suitable alkanes include particularly propane, butane or isobutane. The class (ii) 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 as low as 5:95. It can also be employed in admixture with, for example, compressible/liquefiable alkane gasses. The class (iii) of propellant comprises compressed non-oxidising gasses, and in particular carbon dioxide or nitrogen. Inert gases like neon are a theoretical alternative.

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, C_1-C_3 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.

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.

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 $\mu g.ml^{-1}$ or less, and especially 100 $\mu g.ml^{-1}$ 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 Macrobroth 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 $\mu g.ml^{-1}$ (J.Regos *et al.*, Dermatologica (1979), 158: 72-79) and farnesol: ca. 25 $\mu g.ml^{-1}$ (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 $mg.ml^{-1}$.

Suitable organic anti-microbials are bactericides, for example quaternary ammonium compounds, like cetyltrimethylammonium salts; chlorhexidine and salts thereof; and diglycerol monocaprate, 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 CQ™ available from Zeneca PLC, preferably used at up to 1% 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%.

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.

Method and Use

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.

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.

The invention also provides for use of an aqueous dispersion or an aqueous emulsion the non-thermoplastic polymeric material of particle size 5 to 5000 nm as an antiperspirant active.

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

Examples

Materials

The materials listed in Table 1 were put through some tests as detailed hereinafter.

Table -1

Trade name	Format	Supplier	Average particle size (nm)	Chemical ingredient	Surfactant
KOBOGUARD® 50N	Aqueous emulsion	Kobo	106	Acrylate copolymer	Laureth-21
KOBOGUARD® 50A	Aqueous emulsion	Kobo	121	Acrylates/Ethylhexyl Acrylate Copolymer	Laureth-21
DOWSIL™ FA4103	Aqueous emulsion	Dow	122	Acrylates/Polytrimethylsiloxymethacrylate Copolymer	Laureth-1 Phosphate
Avalure AC120	Aqueous dispersion	Lubrizol	19	Acrylate Copolymer	No surfactant
Baycusan® C1008	Aqueous dispersion	Covestro	31	Polyurethane	No surfactant

Example 1: Aggregation/precipitation formation of compositions

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

Table 2

Reference No.	Aqueous dispersion/emulsion of polymeric material	Water
1	KOBOGUARD® 50N, equivalent to 5 wt% Acrylate copolymer	To 100 wt%
2	KOBOGUARD® 50A, equivalent to 5 wt% Acrylates/Ethylhexyl Acrylate Copolymer	To 100 wt%
3	DOWSIL™ FA4103, equivalent to 5 wt% Acrylates/Polytrimethylsiloxymethacrylate Copolymer	To 100 wt%

The ability of the above compositions to form an aggregation/precipitation under specific conditions was tested by the following procedure:

Testing On A Narrow Capillary Apparatus

An experiment was arranged using the device as disclosed in the International Application WO2018099931 A1 (Unilever).

The device has a 20X20 µm channel. Before use, the channel was filled with water instead of artificial sweat (to simplify the system). The surface tension of the water is strong and prevents its flowing in the capillary. 20 µl of concerned composition according to the invention, (Reference No. 1 to 3) was placed at one end of the channel. When the solvent of the composition at the end of the channel evaporates, the composition is believed to turn into something like an aggregation or precipitate, thereby fully or partially blocking the channel. This phenomenon simulates the manner in which an antiperspirant active agent blocks the sweat ducts in the underarm region

The whole process was monitored under optical microscope (Leica™ DM 2500P).

The pore blocking efficacy was investigated by measuring the flow rate of the water through the capillary. This flow rate is believed to be affected (reduced) by the presence of the aggregation or the precipitate. If flow rate of the water reduces to zero, it indicates the formation of an aggregation or a precipitate which blocks the channel. The water 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 data on the aggregation/precipitation formation of the compositions as per the invention is summarized in Table -3 below:

Table -3

Reference No.	Aggregation/precipitation formation inside the channel	Time (minutes)
1	Yes	40
2	Yes	40
3	Yes	40

The data in Table -3 above indicates that compositions as per the invention (Reference No. 1 to 3) can form an aggregation/precipitation inside the 20X20 µm channel when the solvent evaporates, which further indicates its ability to block sweat ducts or sweat glands when used in an antiperspirant composition. In other words, this observation indicates the suitability of the compositions in accordance with the invention to block sweat ducts or sweat glands like an antiperspirant ingredient.

Example 2: Effect of surfactant

The following compositions were prepared as given in Table -4.

Table -4

Reference No.	Aqueous dispersion/emulsion of polymeric material	Surfactant	Water
A	Avalure AC120, equivalent to 5 wt% Acrylate Copolymer	No	To 100 wt%
B	Baycusan® C1008, equivalent to 5 wt% Polyurethane	No	To 100 wt%
4	Avalure AC120, equivalent to 5 wt% Acrylate Copolymer	2 wt% Steareth-20	To 100 wt%
5	Baycusan® C1008, equivalent to 5 wt% Polyurethane	2 wt% Steareth-20	To 100 wt%

The gelation behaviour of above compositions was tested by following the procedure described earlier. It can be noticed that the Reference compositions A and B are devoid of any surfactant (therefore they are outside the present invention) whereas the corresponding compositions 4 and 5 each contain a surfactant. Therefore, the data or observations recorded at the end of this experiment is useful to appreciate the role of the surfactant in the compositions according to the invention.

The data is summarized in Table -5 below:

Table -5

Reference No.	Aggregation/precipitation formation inside the channel	Time (minutes)
A	No	cannot form an aggregation/precipitation in 24 hours
B	No	cannot form an aggregation/precipitation in 24 hours
4	Yes	40
5	Yes	40

The data in Table -5 above indicates that compositions as per the invention (Reference No. 4 to 5) are capable of forming an aggregation/precipitation inside sweat ducts under the test conditions disclosed earlier, while compositions outside the invention (Examples A to B) do not exhibit this property. It was observed by the microscope that the compositions outside the invention (Examples A to B) could only form a film outside the 20X20 µm channel indicating that the compositions are not capable of diffusing into the sweat ducts without the assistance of the surfactant.

Claims

1. An antiperspirant composition comprising no aluminium or zirconium, said composition comprising:
   (i) an aqueous dispersion of a non-thermoplastic polymeric material of particle size 5 to 5000 nm;
   (ii) a surfactant; and
   (iii) an aqueous cosmetically acceptable carrier;
   wherein said non-thermoplastic polymeric material absorbs no more than 1 g water per gram of its own weight at room temperature (25°C);
   and wherein said polymeric material is an acrylate copolymer, a polyurethane polymer or a copolymer comprising silicone and acrylate.

2. An antiperspirant composition as claimed in claim 1 wherein said composition comprises less than 5% alcoholic solvent, where said solvent is ethanol or isopropanol.

3. An antiperspirant composition as claimed in claim 2 wherein said particle size is from 15 to 500 nm.

4. An antiperspirant composition as claimed in any of claims 1 to 3 wherein said composition comprises 0.5 to 50 wt% of said polymeric material.

5. An antiperspirant composition as claimed in any of claims 1 to 4 wherein said polymeric material absorbs no more than 0.5 g water per gram of its own weight.

6. An antiperspirant composition as claimed in any of claims 1 to 5 wherein said composition comprises 0.01 to 10 wt% of said surfactant.

7. An antiperspirant composition as claimed in any of claims 1 to 6 wherein said surfactant is anionic, amphoteric or non-ionic.

8. An antiperspirant composition as claimed in claim 7 wherein HLB value of the said no-ionic surfactant is greater than 10, preferably greater than 13.

9. An antiperspirant composition as claimed in any of claims 1 to 8 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.

10. An antiperspirant composition as claimed in claim 9 wherein when said composition is a spray, it comprises a propellant and the composition is in the form of an aerosol.

11. A method of reducing perspiration comprising a step of topical application of a composition as claimed in any of claims 1 to 10.

12. A method as claimed in claim 11 wherein said composition is applied to the underarms.

13. A method as claimed in claim 11 or 12 wherein said composition blocks sweat ducts partially or fully in a non-permanent manner.

14. Use of composition as claimed in any of claims 1 to 10 for reduction of bodily perspiration.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/078834

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K8/26 A61K8/28 A61K8/81 A61K8/87 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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2018/099931 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; CONOPCO INC D/B/A UNILEVER [US]) 7 June 2018 (2018-06-07) page 14	1
X	DATABASE GNPD [Online] MINTEL; 21 October 2013 (2013-10-21), anonymous: "Ice Pure Oxygen 24h Deodorant", XP055581649, retrieved from www.gnpd.com Database accession no. 2212470 the whole document	1-9, 11-14
X	US 4 822 596 A (CALLINGHAM MARTIN [GB] ET AL) 18 April 1989 (1989-04-18) example 6	1,10

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

[X] See patent family annex.

* Special categories of cited documents :

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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 January 2020	24/01/2020

Name and mailing address of the ISA/	Authorized officer
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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/078834

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2013/131107 A1 (AMCOL INTERNATIONAL CORP [US]) 6 September 2013 (2013-09-06) examples 5-7	1
T	LILLIAN C. BECKER ET AL: "Final Report of the Cosmetic Ingredient Review Expert Panel Safety Assessment of Polymethyl Methacrylate (PMMA), Methyl Methacrylate Crosspolymer, and Methyl Methacrylate/Glycol Dimethacrylate Crosspolymer", INTERNATIONAL JOURNAL OF TOXICOLOGY, vol. 30, no. 3_suppl, 1 May 2011 (2011-05-01), pages 54S-65S, XP055655609, US ISSN: 1091-5818, DOI: 10.1177/1091581811407352	
X	DATABASE GNPD [Online] MINTEL; 13 December 2006 (2006-12-13), anonymous: "Deodorant Stick", XP55581759, retrieved from www.gnpd.com Database accession no. 626645 abstract	1
X,P	WO 2019/052781 A1 (UNILEVER NV [NL]; UNILEVER PLC [GB]; CONOPCO INC D/B/A UNILEVER [US]) 21 March 2019 (2019-03-21) page 16	1

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2019/078834

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-14

   Antiperspirant compositions comprising various polymer dispersions, and methods and uses of such compositions

1.1. claims: 1-14(partially)

   wherein the polymer is an acrylate

1.2. claims: 1-14(partially)

   wherein the polymer is a polyurethane

1.3. claims: 1-14(partially)

   wherein the polymer is a silicone copolymer

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2019/078834

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2018099931 A1	07-06-2018	NONE	
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		US 2015050227 A1	19-02-2015
		WO 2013131107 A1	06-09-2013
WO 2019052781 A1	21-03-2019	NONE	