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(54) Title: ANTI-PERSPIRANT COMPOSITIONS WITH IMPROVED PROPERTIES

(57) Abstract: The present invention relates to compositions of matter useful in personal care end-use applications. More particu-
larly, it relates to compositions of matter useful in providing deodorant and anti-perspirant compositions.



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Anti-perspirant Compositions with Improved Properties

Field of the Invention

5 The present invention relates to compositions of matter useful in personal care end-use applications. More particularly, it relates to compositions of matter useful in providing deodorant and anti-perspirant compositions.

Background Information

10 Anti-perspirant products are available in today's market in many forms, such as solid sticks, soft-solid sticks, roll-ons, wipes, and aerosols. These products are normally made with an active anti-perspirant agent dispersed in a medium which in non-aqueous products is typically a volatile silicone. Non-aqueous products have sensorial benefits vs. aqueous materials, such as lack of wetness, reduced tackiness, and faster drying. The composition of anti-perspirants is completed with the addition of other materials that are usually hydrophobic, especially in soft-
20 solid and solid stick products.

One drawback associated with prior art formulations is that upon their application to the skin, the hydrophobic nature of the volatile silicones and other ingredients prevents the water of perspiration from dissolving the particles of active stringent to the extent that these particles are coated.

25 Further, as stated in Patent 4,151,272, volatile silicones can take up to 20 hours to volatilize.

In addition, stains caused by prior art anti-perspirants on clothing and the like, or residue of the products on the skin, are difficult to remove owing to their hydrophobic nature.

Further still, the presence of volatile compounds, such as silicones, increases volatile organic compounds ("VOC's") in the environment. This volatility is also a negative factor in the manufacturing of sticks, in which hot processing is required to incorporate the solidifying agents.

Thus, there exists a need for anti-perspirants and deodorants having improved properties including no VOC's, ease of removal of stains left on cloths, ease of removal of residues left on skin, and ease of manufacturing due to the absence of volatile materials. The present invention provides compositions by which this is accomplished.

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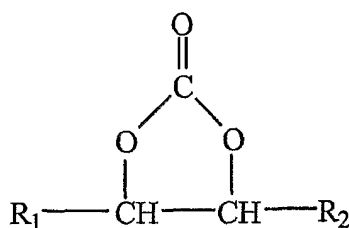
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Summary of the Invention

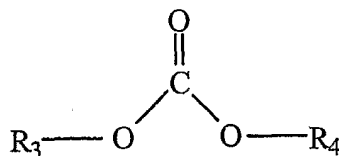
In one broad respect, the present invention provides compositions useful for controlling underarm moisture which comprise from about 0.1% to about 99.9% by weight of a first component that comprises at least one alkylene carbonate having a structure selected from:

i)



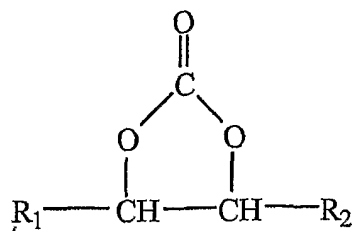
; and

ii)



wherein R₁, R₂, R₃, and R₄ are in each occurrence independently selected from the group consisting of: hydrogen, and a C₁ to C₂₄ hydrocarbyl group, subject to the proviso that R₃ and R₄ are not simultaneously hydrogen. A composition of the invention may take the physical form of sticks, gels, roll-ons, wipes, pump sprays, and aerosols.

In another broad respect the present invention provides compositions useful for controlling underarm moisture which comprises at least one alkylene carbonate having the structure:



in which R₁ and R₂ may each be independently selected from the group consisting of any C₁ to C₄ alkyl group, wherein the compositions may exist in a form selected from the group consisting of: sticks, gels, roll-ons, wipes, pump sprays, and aerosols.

- 5 In one embodiment the compositions of the invention comprise an effective perspiration-inhibiting amount of an anti-perspirant active ingredient selected from the group consisting of: zirconium compounds, aluminum compounds, zinc compounds and compounds which contain two or more of zirconium, zinc, and aluminum. In one embodiment the compositions of the invention comprise an alkylene carbonate present in any amount between about 12 % to about 90 % by
- 10 weight based on the total weight of said composition. In one embodiment the compositions of the invention include an anti-perspirant active ingredient, present in any amount between about 5 % and 30 % by weight based on the total weight of said composition. According to alternate embodiments, a composition according to the invention may further include one or more ingredients selected from the group consisting of: emollients, absorbents, anti-microbial agents,
- 15 perfumes, dyes, and masking agents.

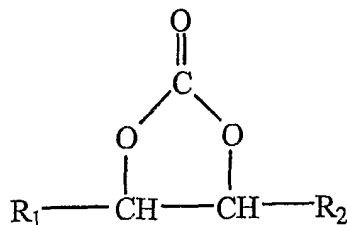
Preferably, a composition according to the invention is free from silicones.

Detailed Description

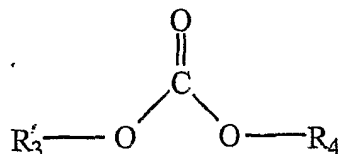
The present invention provides for the replacement of volatile compounds in prior art anti-perspirant and deodorant formulations with non-volatile alkyl carbonates and/or alkylene carbonates. The invention is applicable to anti-perspirant, deodorant, or anti-perspirant and
5 deodorant compositions which exist in a physical form selected from the group consisting of sticks, gels, rolls-ons, wipes, pump sprays, and aerosols.

In a broad sense, deodorants according to the prior art typically contain: a) at least one astringent anti-perspirant compound material; b) a carrier for the active ingredient(s); and c) a
10 series of other ingredients required to complete the formulation, such as solidifying agent(s) in sticks, gelling agent(s) in soft-solids, and suspending agent(s) in roll-ons. In the case of aerosols, a propellant gas is further required. Other optional ingredients which may be included in a formulation according to the present invention include emollients, absorbents, anti-microbials, perfumes, and masking or coloring agents. The complete package is tailored towards delivering
15 a final product with the desirable sensorial properties.

The improvement of this invention comprises the replacement of volatile compounds, preferentially volatile silicones, with one or more non-volatile alkylene carbonates having the structure:



or



wherein R_1 , R_2 , R_3 , and R_4 are in each occurrence independently selected from the group
5 consisting of: hydrogen, and a C_1 to C_{24} hydrocarbyl group, subject to the proviso that R_3 and R_4 are not simultaneously hydrogen. A composition of the invention may take the physical form of sticks, gels, roll-ons, wipes, pump sprays, and aerosols.

The alkylene carbonates and alkyl carbonates used in this invention to replace the volatile
compounds normally used in these products, such as volatile silicones, have relatively high
10 boiling points around 250°C , and low vapor pressures, below about 0.03 mmHg. At first glance, their physical properties would be expected to disqualify the alkylene carbonates as being useful for replacing volatile compounds in personal care formulations such as antiperspirants and deodorants, since it is well-known that non-volatile materials normally yield products which leave tacky and non-drying residues, which render them unacceptable for such end-use
15 applications.

We have surprisingly found that the direct application of alkylene carbonates to the skin results in the formation of a thin film, similar in feel to that of volatile silicones, that disappears

quickly leaving the skin soft and non-greasy. Consequently their lack of volatility has no negative impact on the actual application of the product.

The anti-perspirants of this invention have the added benefit that they do not emit VOC's. For the purposes of the National Pollutant Inventory, the definition of VOC is "Any chemical
5 compound based on carbon chain or ring (and also containing hydrogen) with a vapour pressure greater than 2 mmHg at 25° C, excluding methane". The vapour pressure of the alkylene carbonates of this invention have vapour pressures below 0.03 mmHg, which is well below the 2 mmHg required by the VOC definition.

The alkylene carbonates have refractive indices on the order of about 1.42 - 1.43 range,
10 which makes them very valuable for delivering the active on the skin with reduced whitening. The refractive indices of volatile silicones commonly employed in personal care end-use compositions are about 1.39.

A unique property of the alkylene carbonates is their limited water solubility which results in products having a reduced hydrophobic nature. The solubility of propylene carbonate
15 in water is limited to 15%, and that of butylene carbonate to about 5%. This limited solubility permits faster interaction between the water of perspiration and the active ingredient. An additional and very valuable benefit to the consumer derived from this partial solubility in water is that stains on clothes or residues of these compositions on skin can be easily washed-off. In addition the non-volatile nature of the carbonates makes the manufacturing of these products,
20 especially those requiring hot processing, a simpler and safer procedure than when volatile compounds are used.

Incorporation of one or more alkylene carbonates into a deodorant or anti-perspirant formulation according to the present invention may be undertaken regardless of what active ingredients are present in the formulation. Various compounds of aluminum and zirconium are known to be useful as active ingredients in anti-perspirants, including without limitation:

- 5 aluminum zirconium tetrachlorohydrate (CAS Registry Number: 057158-29-9); aluminum chlorohydrate; aluminum zirconium; potassium alum, and other compounds of aluminum.

As used in this specification and the appended claims, the word "hydrocarbyl", when referring to a substituent or group is used in its ordinary sense, which is well-known to those skilled in the art. Specifically, it refers to a group having a carbon atom directly attached to the
10 remainder of the molecule and having predominantly hydrocarbon character. Examples of hydrocarbyl substituents or groups include: (1) hydrocarbon substituents, that is, aliphatic (e.g., alkyl or alkenyl), alicyclic (e.g., cycloalkyl, cycloalkenyl) substituents, and aromatic-, aliphatic-, and alicyclic-substituted aromatic substituents, as well as cyclic substituents wherein the ring is completed through another portion of the molecule (e.g., two substituents together form an
15 alicyclic radical); (2) substituted hydrocarbon substituents, that is, substituents containing non-hydrocarbon groups which, in the context of this invention, do not alter the predominantly hydrocarbon substituent (e.g., halo (especially chloro and fluoro), hydroxy, alkoxy, mercapto, alkylmercapto, nitro, nitroso, and sulfoxy); (3) hetero substituents, that is, substituents which, while having a predominantly hydrocarbon character, in the context of this invention, contain
20 other than carbon in a ring or chain otherwise composed of carbon atoms. Heteroatoms include sulfur, oxygen, nitrogen, and encompass substituents as pyridyl, furyl, thienyl and imidazolyl. In

general, no more than two, preferably no more than one, non-hydrocarbon substituent will be present for every ten carbon atoms in the hydrocarbyl group; typically, there will be no non-hydrocarbon substituents in the hydrocarbyl group.

The following examples shall be construed as exemplary of the present invention, and not
 5 delimitive thereof in any way. Unless specified otherwise, all parts and percentages are by weight.

Example I - Anti-perspirant Stick with Propylene Carbonate

10	propylene carbonate	44%
	stearyl alcohol	16%
	steareth-10	14%
	Al-Zr tetrachlorohydrax, gly	20%
	talc	6 %
15	fragrance:	q.s.

Example I was prepared mixing the first three ingredients at 75° – 80°C, followed by addition of the Al-Zr salt and talc. The formulation was poured into the appropriate containers at about 50°
 C to allow solidification. No fumes and weight loss were observed during the manufacturing or
 20 filling processes.

Example II - Anti-perspirant Stick with Butylene Carbonate

25	butylene carbonate	49%
	stearyl alcohol	13%
	hydrogenated castor oil	4%
	PPG-14 butyl ether	4%
	Al-Zr tetrachlorohydrax, gly	20%
30	talc	10%
	fragrance	q.s.

Example II was prepared mixing the first four ingredients at 75°–80° C, followed by addition of the Al-Zr salt and talc. The formulation was poured into the appropriate containers at about 50° C to allow solidification. No fumes and no weight loss were observed during the manufacturing or filling processes.

5 Examples I and II provided stick anti-perspirants having acceptable hardness and rigidity.

For comparative evaluation purposes, a commercially available premium anti-perspirant stick was selected. It was made of Al-Zr salt as active, volatile silicone as carrier, and stearyl alcohol and hydrogenated castor oil and solidifying agents. Talc and a dimethicone were also part of the formulation. This was compared with an anti-perspirant made in accordance with
10 example II above. In terms of VOC's, the conventional stick with a nominal weight of 48 gm, lost about 30 milligrams when left open for 40 minutes @ 25° C, whereas the stick of the example II of the invention lost no weight. The pay-load of both products was about the same, at 0.08 g after 4 strokes on the arm of a panelist, each stroke about 10 cm long. Neither product left a visible residue. Both sticks were sensorially rated the same in non-tackiness and quick drying.

15 No-sweat controlled experiments were conducted using the FDA guidelines for OTC anti-perspirant drug products. Nevertheless, the panelists that used these products for one week, one in each underarm, noticed no significant differences in terms of sweat and/or odor control, as these effects were excellent for both samples. The panelist did report that the formulation made according to example II was easier to wash from the underarm as evidenced by the fact that there
20 was no residue whatsoever remaining after the showering process.

A clear difference was observed in the removal of the stains left by the sticks on a black cotton shirt used by one panelist for several days. These stains appear in shirt in the underarm region as result of product transferred by contact from the body to the shirt. The shirt, containing stains from both sticks, was washed in a conventional washer with a conventional laundry detergent. The stains corresponding to the deodorant stick of example II of this invention were totally removed, whereas the stains corresponding to the commercial product were not.

To further illustrate the difference, another black shirt was stained with about 0.1 gm of each product in a 10 cm² area. The residue from the stick of the invention was easily removed with a damp cloth, whereas the residue from the conventional stick remained in the shirt even after the shirt was washed in a washer with a laundry detergent.

Example III - anti-perspirant roll-on

propylene carbonate:	76%
Al-Zr Trichlorohydrex, gly	20%
fumed silica	4%
fragrance	q.s.

The above composition was prepared dispersing the fumed silica in the propylene carbonate, followed by the dispersion of the anti-perspirant powder. The fumed silica helps to suspend the active. This composition was applied on the skin using a roll-on dispenser, rendering a non visible residue, with very little tackiness, and quickly drying into a non-sticky residue.

Example IV - anti-perspirant wipe

	propylene carbonate	86%
	Al-Zr Trichlorohydrate, gly	12%
5	fume silica	2%
	fragrance	q.s.

The above composition was prepared dispersing the fumed silica in the propylene carbonate, followed by the dispersion of the anti-perspirant powder. In this composition the fumed silica was reduced to 2% since only limited suspending properties are needed. Wipes prepared with the above product glide smoothly on the skin, leaving it not tacky and without white residue. Unwanted product on skin can be easily washed off. These wipes remained wet if left exposed to the air, due to the non-volatility of the carbonate.

15

Example V, soft solid antiperspirant

	Ethylehexyl carbonate	53.41
	Mineral Oil	18.42
20	SynchroWax (C18-36)	7.37
	Active	20.25
	Fumed silica	<u>0.55</u>
	TOTAL	100.00

As is well-known, the prior art is replete with many different compositions and combinations which are purported as being useful in the control and/or deodorization of underarm sweat-derived nuisances. The various prior art compositions, in their finished, ready-for-use manufactured form, include sticks, gels, roll-ons, wipes, pump sprays, and aerosols. Owing to the wide variance in the formulation of the different vehicles of delivery associated with

each of these product types, ingredients other than anti-perspirant active materials are often present in such formulations and manufactures, which may include, without limitation: fatty acids, esters, alkyl sulfates, alkanolamines, amine oxides, alkali carbonates, water, ethanol, isopropanol, pine oil, sodium chloride, citric acid, citrates, nitriloacetic acid, sodium silicate, polymers, alcohol

5 alkoxylates, zeolites, alkali sulfates, hydrotropes, dyes, fragrances, preservatives, polyacrylates, essential oils, alkali hydroxides, alkylaromatic sulfonates, ether sulfates, alkylphenol alkoxylates, fatty acid amides, alpha olefin sulfonates, paraffin sulfonates, betaines, chelating agents, tallowamine ethoxylates, polyetheramine ethoxylates, ethylene oxide/propylene oxide block copolymers, alcohol ethylene oxide/propylene oxide low foam surfactants, glycols, ethers, methyl

10 ester sulfonates, alkyl polysaccharides, N-methyl glucamides, alkylated sulfonated diphenyl oxide, polyethylene glycols, and other materials known to be included in deodorant and anti-perspirant formulations.

Consideration must be given to the fact that although this invention has been described and disclosed in relation to certain preferred embodiments, obvious equivalent modifications and

15 alterations thereof will become apparent to one of ordinary skill in this art upon reading and understanding this specification and the claims appended hereto. The present disclosure includes the subject matter defined by any combination of any one of the various claims appended hereto with any one or more of the remaining claims, including the incorporation of the features and/or limitations of any dependent claim, singly or in combination with features and/or limitations of

20 any one or more of the other dependent claims, with features and/or limitations of any one or more of the independent claims, with the remaining dependent claims in their original text being

read and applied to any independent claim so modified. This also includes combination of the features and/or limitations of one or more of the independent claims with the features and/or limitations of another independent claim to arrive at a modified independent claim, with the remaining dependent claims in their original text being read and applied to any independent
5 claim so modified. Accordingly, the presently disclosed invention is intended to cover all such modifications and alterations, and is limited only by the scope of the claims which follow, in view of the foregoing and other contents of this specification.

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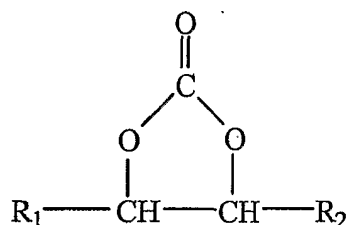
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What is claimed is:

1) A composition useful for controlling underarm moisture which comprises from about 0.1% to about 99.9% by weight of a first component that comprises at least one organic carbonate having a

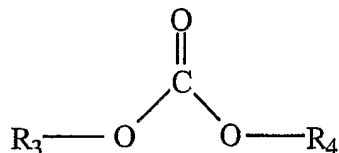
5 structure selected from:

i) an alkylene carbonate of structure:



; and

ii) a dialkyl carbonate having the structure:



10 and mixtures thereof, wherein R_1 , R_2 , R_3 , and R_4 are in each occurrence independently selected from the group consisting of: hydrogen, and a C_1 to C_{24} hydrocarbyl group, subject to the proviso that R_3 and R_4 are not simultaneously hydrogen.

2) A composition according to claim 1 comprising an effective perspiration-inhibiting amount of an anti-perspirant active ingredient selected from the group consisting of: zirconium compounds, aluminum compounds, zinc compounds and compounds which contain two or more of zirconium, zinc, and aluminum.

5

3) A composition according to claim 1 wherein said alkylene carbonate is present in any amount between about 12 % to about 90 % by weight based on the total weight of said composition.

4) A composition according to claim 2 wherein said alkylene carbonate is present in any amount

10 between about 12 % to about 90 % by weight based on the total weight of said composition.

5) A composition according to claim 2 wherein said anti-perspirant active ingredient is present in any amount between about 5 % and 30 % by weight based on the total weight of said composition.

15 6) A composition according to claim 4 wherein said anti-perspirant active ingredient is present in any amount between about 5 % and 30 % by weight based on the total weight of said composition.

7) A composition according to any foregoing claim and further comprising one or more ingredients selected from the group consisting of: emollients, absorbents, anti-microbial agents, perfumes,

20 dyes, and masking agents.

8) A composition according to any foregoing claim which is substantially free from silicones.

9) A composition according to any foregoing claim which exists in a form selected from the group consisting of: sticks, gels, roll-ons, wipes, pump sprays, and aerosols.

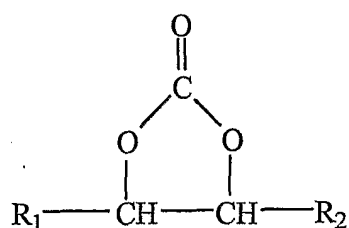
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10) A composition according to claim 1 wherein said organic carbonate is a mixture which comprises an alkylene carbonate and a di-alkyl carbonate, wherein the ratio of alkylene carbonate to alkylene carbonate in said mixture is in the range of between about 1: 10 to about 10: 1.

10 11) An anti-perspirant composition which comprises:

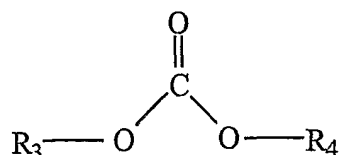
A) from about 0.1% to about 99.9% by weight of a first component that comprises at least one organic carbonate having a structure selected from:

i) an alkylene carbonate having the structure:



; and

15 ii) a dialkyl carbonate having the structure:



and mixtures thereof, wherein R_1 , R_2 , R_3 , and R_4 are in each occurrence independently selected from the group consisting of: hydrogen, and a C_1 to C_{24} hydrocarbyl group, subject to the proviso that R_3 and R_4 are not simultaneously hydrogen; and

5 B) from about 0.1% to about 99.9% by weight of an antiperspirant active.

12) The antiperspirant composition of claim 11 wherein the antiperspirant active is selected from the group consisting of aluminum salts, zirconium salts, and combinations thereof.

10

13) A composition according to any foregoing claim further comprising one or more materials selected from the group consisting of: fatty acids, esters, alkyl sulfates, alkanolamines, amine oxides, alkali carbonates, water, ethanol, isopropanol, pine oil, sodium chloride, citric acid, citrates, nitriloacetic acid, sodium silicate, polymers, alcohol alkoxylates, zeolites, alkali sulfates, 15 hydrotropes, dyes, fragrances, preservatives, polyacrylates, essential oils, alkali hydroxides, alkylaromatic sulfonates, ether sulfates, alkylphenol alkoxylates, fatty acid amides, alpha olefin sulfonates, paraffin sulfonates, betaines, chelating agents, tallowamine ethoxylates, polyetheramine ethoxylates, ethylene oxide/propylene oxide block copolymers, alcohol ethylene oxide/propylene oxide low foam surfactants, glycols, ethers, methyl ester sulfonates, alkyl 20 polysaccharides, N-methyl glucamides, alkylated sulfonated diphenyl oxide, and polyethylene glycols.

14) A deodorant composition according to any foregoing claim, including a vehicle in the form of a lotion comprising a liquid carrier of a lower alcohol or an aqueous alcoholic media.

15) A deodorant composition according to claim 14, wherein said lotion contains non-volatile
5 polar or non-polar ingredients selected from the group consisting of polyhydric alcohols and emollient oils.

16) A deodorant composition according to any foregoing claim, including a vehicle that is in the form of a fluid comprising a suspending or thickening agent for use as a roll-on.

10

17) A deodorant composition according to any foregoing claim, including a vehicle that is in the form of a stick comprising a monohydric or polyhydric alcohol gelled with a fatty alcohol or fatty amide or combination thereof.

15 18) A deodorant composition according to any foregoing claim, including a vehicle that is in the form of a cream comprising an aqueous emulsion of a fatty material.

19) A deodorant composition according to any foregoing claim wherein said organic carbonate is a mixture which comprises an alkylene carbonate and a di-alkyl carbonate, wherein the ratio of
20 alkylene carbonate to alkylene carbonate in said mixture is in the range of between about 1: 10 to about 10: 1.