(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
20 August 2009 (20.08.2009)

PCT

(10) International Publication Number
WO 2009/101615 A1

(51) International Patent Classification:
A61K 8/99 (2006.01) *A61Q 15/00* (2006.01)

(21) International Application Number:
PCT/IL2009/000157

(22) International Filing Date:
11 February 2009 (11.02.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/064,042 12 February 2008 (12.02.2008) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

WO 2009/101615 A1

(54) Title: METHODS AND COMPOSITIONS FOR CONTROLLING BODY ODOR

(57) Abstract: A method of controlling body odor is disclosed. The method comprises topically administering to a subject an effective amount of at least one species of a lytic bacteriophage capable of killing odor-generating bacteria. Deodorant compositions comprising such bacteriophages are also disclosed.

METHODS AND COMPOSITIONS FOR CONTROLLING BODY ODOR

FIELD AND BACKGROUND OF THE INVENTION

The present invention, in some embodiments thereof, relates to methods and compositions for controlling body odor.

Various skin areas of the body contain sweat glands that produce perspiration, or sweat, on the surface of the skin. Numerous metabolic or biological processes play a role in the production of perspiration including temperature regulation, physical activity or exertion, emotional stress such as anger, fear and excitement, hormonal fluctuations, menopause, medicinal effects, and disease. Perspiration produced by the sweat glands appears on the surface of the epidermis, which constitutes the outermost layer of the skin. The sweat glands themselves are found in the reticular region of the dermis, the layer of the skin located just beneath the epidermis.

Some skin areas of the body perspire more profusely than others, one reason being the higher density or concentration of sweat glands in some skin areas of the body. Furthermore, some skin areas of the body where perspiration is produced have only limited exposure to light and/or air due to their anatomical location and/or their being normally covered by clothing. The axillae, otherwise known as the underarms or armpits, and the feet are skin areas of the body where perspiration is produced, oftentimes profusely, and where there is typically minimal light and ventilation resulting in a damp environment. These skin areas present an environment especially favorable to the proliferation of various bacterial organisms that ordinarily colonize the surface of the epidermis and become mixed with the perspiration produced thereon. These organisms, including *Corynebacterium xerosis, Corynebacterium tuberculostearicum, Corynebacterium minutissimum, Staphylococcus epidermis, Staphylococcus haemolyticus, Propionibacterium, micrococcus, Acinetobacterium and Bacillus licheniformis*, are not easily removable from the skin even by vigorous washing with soap and water. Further, these organisms also demonstrate a resistance to available antibiotics including penicillin and methycillin.

Ara et al., [Canadian Journal of Microbiology, 52: 357-364, 2006] in a recent study identified specific microorganisms responsible for foot malodor and evaluated the

mechanism of occurrence. The main agent responsible for the malodor to feet was found to be isovaleric acid produced by both *Staphylococcus epidermidis* and *Bacillus subtilis*. These bacteria are present in the normal cutaneous microbial flora that degrades leucine (present in sweat).

Where the skin areas are not readily accessible due to their anatomical location and/or being covered by clothing, as is the case for the underarms and feet, perspiration produced on the skin surface during the course of a person's normal day typically cannot be dried, wiped or washed away soon after being produced. Furthermore, hairs growing from the skin surface, as is often the case for the underarms in particular, may act to trap or retain perspiration on or against the skin. Consequently, the perspiration produced on the skin of the underarms and feet will typically remain on and/or in contact with the skin surface for a considerable length of time, thereby creating the sustained damp or moist environment that is typical of the underarms and feet and that favors the proliferation of bacterial organisms.

Although perspiration by itself is essentially an odorless fluid, the degradation or decomposition of perspiration by the bacterial organisms on the skin causes an offensive odor, commonly referred to as body odor, to be produced. The underarms and feet provide an optimal environment for the production of body odor in that a larger population of bacterial organisms may be available to effect degradation or decomposition of perspiration, a greater quantity of perspiration may be available for degradation or decomposition by the bacterial organisms, degradation or decomposition of perspiration into body odor may occur at a faster rate due to the larger population of bacterial organisms and/or the greater quantity of perspiration, and/or degradation or decomposition of perspiration into body odor may occur over a longer period of time due to the conditions favorable to the production of body odor being sustained for relatively long periods of time.

Body odor is a great cause of concern for most individuals due to the adverse impact that body odor has on many aspects of a person's life. Individuals afflicted with body odor oftentimes experience various problems and disorders including social anxiety, social isolation or withdrawal, lack of confidence, embarrassment, humiliation, low self-esteem, shame, frustration, educational underachievement, employment difficulties and unsuccessful interpersonal relationships. In view of the widespread

aversion to body odor and the fact that regular washing of the skin with soap and water does not effectively control body odor, various commercial deodorant products dedicated to controlling body odor have been proposed for use on the underarms and feet.

Commercial underarm deodorant products are typically chemically formulated substances provided in a medium allowing a layer, coating or film of the substance to be applied to the surface of the skin in the areas of the underarms. Commercial underarm deodorant products most commonly comprise an antiperspirant component thereby attempting to control body odor by reducing the amount of perspiration produced by and on the skin, but do not directly act on the underlying bacterial organisms responsible for degrading or decomposing the perspiration into body odor. The anti-odor components found in commercial underarm deodorant products generally comprise chemical agents selected for their ability to diffuse odor. In many products, the anti-odor components attempt to absorb or merely mask the odor. Like the anti-perspirant components, the anti-odor components do not directly act on the underlying bacterial organisms responsible for degrading or decomposing perspiration into body odor.

Like commercial underarm deodorant products, commercial foot deodorant products typically attempt to control foot odor by reducing perspiration and/or by diffusing foot odor but do not address the issue of bacterial organisms responsible for degrading or decomposing perspiration on the feet into body odor.

Exemplary agents used for the treatment of malodor include alumina, zinc (Zn), Ag-zeolite(silver-exchanged zeolite), pyroligneous acid , boric acid + sublimed sulfur powder, isopropylmethylphenol, Z np-phenolsulfonate, cetyltrimethylammonium bromide, hexamine 4, ZnO_2, cis-cyclohexane-1,2-dicarboxylic acid, urotropin, Cu, Ag, and/or Cu-Ag alloy particles, poly(vinyl acetate), emulsion 60, foaming agent 30, ethylene glycol 5, and antifoam agent, Cu powder (particle size – approx 50 m), and C black.

Because deodorant products are applied to the skin and are allowed to remain on the skin, it is possible for the chemical agents in the products to be absorbed by the body via the skin. Exposure to the chemical agents in deodorant products is a cause of concern, especially in view of recent scientific evidence suggesting that the chemical agents used in commercial deodorant products may be potentially harmful to humans.

For example, many commercial deodorant products contain aluminum which has been implicated in some scientific studies as a causative factor in Alzheimer's Disease and in cancer. The health risks associated with exposure to the chemical agents in deodorant products may be exacerbated by the fact that such products are often copiously applied by individuals to their skin and are used by most individuals with regular frequency. Further deodorant products typically remain on the skin for a significant length of time. Despite potential health risks such products remain widely used due to the stigma associated with body odor and the lack of viable alternatives to commercial deodorant products.

The bacteriophages (phages) are a diverse group of viruses whose life cycle is connected exclusively with bacteria cells. Bacteriophages are characterized by a lysogenic or lytic life cycle. As anti-bacterial agents, lytic bacteriophages are especially useful which, after infection by bacteria cells to which they are sensitive, they replicate within them, leading to their total destruction (by lysis) and the release of new phages which attack and destroy subsequent bacteria cells. This process may occur both in vitro and in vivo.

One of the essential characteristics of bacteriophages is the well-known high specificity of their lytic activity. This feature is exploited in, for example, species determination (phage typing) of various bacteria. Other known applications of bacteriophages include their usefulness as tools in molecular biology, for example in the expression and selection of specific proteins, and in sterilization and cleansing media. Modified phages are used in the production of vaccines.

Phage therapy has been employed on a wide scale since the Second World War at the Institute of Microbiology and Virology of Tbilisi, Georgia. A bank of various phage preparations is used there in the treatment of bacterial infections and in prophylaxis.

Available data indicate a great effectiveness of phage therapy. Similar research has been conducted in Poland for over 25 years. At the Bacteriophage Laboratory of the Institute of Immunology and Experimental Therapy of the Polish Academy of Sciences in Wroclaw the phage therapy is used treatment of infections caused by drug-resistant forms of bacteria and those not susceptible to antibiotics The phage therapy carried out

there over the last 14 years, which has included 1473 patients with purulent infections of different tissues and organs, indicates the high efficacy of phage therapy.

US Patent Appl. No. 20070014770 teaches treatment of skin disorders such as acne with bacteriophages.

US Patent No. 6,737,079 teaches compositions formulated for topical administration for treating bacterial infections that comprise lytic enzymes present in phage infected bacteria.

SUMMARY OF THE INVENTION

According to an aspect of some embodiments of the present invention there is provided a method of controlling body odor in a subject in need thereof, the method comprising topically administering to the subject an effective amount of at least one species of a lytic bacteriophage capable of killing an odor-generating bacteria, thereby controlling the body odor.

According to an aspect of some embodiments of the present invention there is provided a deodorant comprising as an active agent at least one species of lytic bacteriophage being capable of killing an odor-generating bacteria and a carrier, the deodorant being formulated for topical administration to a subject.

According to some embodiments of the invention, the odor-generating bacteria are under-arm odor generating bacteria.

According to some embodiments of the invention, the odor-generating bacteria are foot odor generating bacteria.

According to some embodiments of the invention, the odor-generating bacteria are capable of generating iso-valeric acid.

According to some embodiments of the invention, the odor generating bacteria is of a genus selected from the group consisting of a *Staphylococcus*, a *Propionibacteria*, a *Bacillus* and a *Corynebacterium*.

According to some embodiments of the invention, the under-arm odor generating bacteria are selected from the group consisting of *C. jeikeium, C. Striatum, C. Bovis, C. Xerosis, C. Tuberculostearicum, C. Minutissimum, S. Epidermidis, S. Haemolyticus* and *Bacillus licheniformis*.

According to some embodiments of the invention, the foot odor generating bacteria are selected from the group consisting of *Bacillus subtilis, P. avidum, S. epidermidis, S. hominis* and *Corynebacterium sp.*

According to some embodiments of the invention, the the foot odor generating bacteria is *Bacillus subtilis*.

According to some embodiments of the invention, the at least one species of a lytic bacteriophage comprises a poly-valent bacteriophage.

According to some embodiments of the invention, the at least one species of a lytic bacteriophage comprises a mono-valent bacteriophage.

According to some embodiments of the invention, the deodorant is formulated as a formulation selected from the group consisting of a spray, a cream, a gel, a stick and a powder.

According to some embodiments of the invention, the deodorant further comprises a perfume.

According to some embodiments of the invention, the deodorant further comprises an agent which promotes diffusion of the at least one species of lytic bacteriophages.

Unless otherwise defined, all technical and/or scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention pertains. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of embodiments of the invention, exemplary methods and/or materials are described below. In case of conflict, the patent specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and are not intended to be necessarily limiting.

DESCRIPTION OF SPECIFIC EMBODIMENTS OF THE INVENTION

The present invention, in some embodiments thereof, relates to methods and compositions for controlling body odor and more particularly for controlling foot odor.

Before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not necessarily limited in its application to the details set

forth in the following description or exemplified by the Examples. The invention is capable of other embodiments or of being practiced or carried out in various ways.

Body malodor is formed when fresh perspiration, which is odorless *per se*, is metabolized by bacteria such as Staphylococci and Corynebacteria, both genera belonging to the gram-positive Eubacteriaceae.

The main agent responsible for the malodor to feet was found to be isovaleric acid produced by both *Staphylococcus epidermidis* and *Bacillus subtilis*. Both these bacteria belong to the normal cutaneous microbial flora that degrades leucine (present in sweat).

The present inventors have devised of a novel method for controlling body odor by specifically eliminating the bacteria present in the skin that are responsible for body odor whilst leaving the other bacterial flora on the skin unaffected. The method takes advantage of the high specificity of bacteriophages together with their ability to thrive in a dark and moist environment.

Thus according to one aspect of the present invention there is provided a method of controlling body odor in a subject in need thereof, the method comprising topically administering to the subject an effective amount of at least one species of a lytic bacteriophage capable of killing an odor-generating bacteria, thereby controlling the body odor.

As used herein, the phrase "body odor" refers to the odors emanating from the body as a result of sweat, sebaceous and senile glands emission combined with metabolic activity of human microbial inhabitants.

According to one embodiment the body odor emanates from the foot or the armpit.

The phrase "topically administering" refers to topical application of the bacteriophage to the outer layer of the epidermis, i.e. the stratum corneum. The administration may be effected by rubbing, pouring, sprinkling, spraying, applying etc.

The administering may be effected at various time intervals, preferably once or twice a day (for example, following showering or prior to getting dressed), as further described herein below.

As used herein the phrase "lytic bacteriophage", also referred to herein as "lytic phage" refers to a virus-like particle, or component thereof that specifically infects and

kills bacteria. Lytic phages are parasites that multiply inside bacterial cells by using some or all of the hosts' biosynthetic machinery, and lyse (i.e. destroy) the bacteria after replication of the virion. The bacteriophages used in accordance with the present invention may be any lytic bacteriophage that is effective against an odor generating bacterium.

The term "phage component" or "phage components" refers to any phage component including but not limited to the tail, or a phage protein or other molecular assemblage that is effective in killing, reducing growth, or reproduction of a target bacteria, or a plurality of target bacteria.

The lytic bacteriophage of the present invention may be effective against (i.e. capable of killing) one particular strain of a particular species of bacteria (i.e. monovalent) or may be effective against a plurality of strains or even species of odor-generating bacteria (i.e. polyvalent).

According to one embodiment of the present invention, the bacteriophages of the present invention are highly specific towards odor-generating bacteria and are not capable of killing non-odor-generating bacteria. Accordingly, the present invention envisages that the bacteriophages of the present invention are capable of killing at least 5 times the quantity of odor-generating bacteria as they are capable of killing non-odor generating bacteria at a particular concentration. According to another embodiment, the bacteriophages of the present invention are capable of killing at least 10 times the quantity of odor-generating bacteria as they are capable of killing non-odor generating bacteria at a particular concentration. According to still another embodiment, the bacteriophages of the present invention are capable of killing at least 20 times the quantity of odor-generating bacteria as they are capable of killing non-odor generating bacteria at a particular concentration. According to still another embodiment, the bacteriophages of the present invention are capable of killing at least 50 times the quantity of odor-generating bacteria as they are capable of killing non-odor generating bacteria at a particular concentration. According to still another embodiment, the bacteriophages of the present invention are capable of killing at least 100 times the quantity of odor-generating bacteria as they are capable of killing non-odor generating bacteria at a particular concentration.

Exemplary genuses of odor generating bacteria include, but are not limited to *Staphylococcus, Propionibacterium, Bacillus* and *Corynebacterium.*

Specific examples of under-arm odor generating bacteria include, but are not limited to *C. jeikeium, C. striatum, C. bovis, C. xerosis, C. tuberculostearicum, C. minutissimum, S. epidermidis, S. haemolyticus* and *Bacillus licheniformis.*

Specific examples of foot odor generating bacteria include are those that produce isovaleric acid and/or propionic acid, including but not limited to *Bacillus subtilis, P. avidum, S. epidermidis, S. hominis* and *Corynebacterium sp.* H996.

Bacteriophages specific for one or more than one target pathogen may be isolated using standard techniques in the art for example as taught in Maniatis et al (1982, Molecular cloning: a laboratory manual, Cold Spring Harbor Laboratory, Cold Spring Harbor, N.Y.; which is incorporated herein by reference). If desired, a cocktail of different bacteriophages strains may be used to target a particular strain or species of bacterial pathogen. For example, the cocktail may comprise a plurality of bacteriophages, wherein each strain is capable of killing a different *Bacillus subtilis* strain. It will be appreciated that the cocktail may also comprise a plurality of bacteriophages, wherein each bacteriophage targets a different species of a bacterial pathogen. For example, the cocktail may comprise two species of bacteriophages, the first species being capable of killing *Bacillus subtilis* and the second species being capable of killing *S. Epidermidis.*

Typically, isolation of bacteriophages follows several basic steps, including: bacteriophage typing to establish susceptibility of the pathogenic bacteria; selecting the correct bacteriophage or bacteriophage panel; picking a single bacteriophages plaque for each bacteriophage type to ensure uniform preparation; obtaining a high bacteriophage titer; collecting the bacteriophage; removing host bacteria from the bacteriophage crude extract; purifying the bacteriophage crude extract from endotoxins and other bacterial debris.

The present invention also contemplates using bacteriophages that have already been isolated, and are commercially available, such as from ATCC. For example bacteriophages against *Bacillus subtilis* are commercially available from ATCC (23059-B1, 15841-B1 and 15563-B1).

The bacteriophages of the present invention may be applied to the skin directly or as part of a composition which has been formulated for topical administration to the subject.

Thus, according to another aspect of the present invention there is provided a deodorant comprising as an active agent at least one species of a lytic bacteriophage being capable of killing an odor-generating bacteria and a physiologically acceptable carrier, the deodorant being formulated for topical administration to a subject.

The term "deodorant" refers to a composition capable of reducing capable of reducing the unpleasant odor resulting from the decomposition of human sweat by bacteria.

Herein, the term "active ingredient" refers to the bacteriophages of the present invention accountable for the biological effect.

Hereinafter, the phrases "physiologically acceptable carrier" and "pharmaceutically acceptable carrier" which may be interchangeably used refer to a carrier or a diluent that does not cause significant irritation to an organism and does not abrogate the biological activity and properties of the administered compound. An adjuvant is included under these phrases.

Herein the term "excipient" refers to an inert substance added to a pharmaceutical composition to further facilitate administration of an active ingredient. Examples, without limitation, of excipients include calcium carbonate, calcium phosphate, various sugars and types of starch, cellulose derivatives, gelatin, vegetable oils and polyethylene glycols.

The deodorant of the present invention may also comprise cosmetic adjuvants chosen from waxes, softeners, antioxidants, opacifiers, stabilizers, moisturizers, vitamins, perfume, fragrances, bactericides, preserving agents, polymers, thickeners, propellants or any other ingredient usually used in cosmetics for this type of application.

The deodorant of the present invention may also comprise agents capable of promoting diffusion of the bacteriophages. Such agents include for example: Tween 80, 20, 40, mainly non-ionic surfactants, Ca^{++} and Mg^{++} as adsorption enhancer.

It will be appreciated that the bacteriophages of the present invention may be formulated with other active agents (e.g. fungicides and/or antibiotics) for the treatment of a variety of foot diseases. Further, the bacteriophages of the present invention may be

formulated with a skin soothing agents. Exemplary skin soothing agents include, but are not limited to menthol, camphor, eugenol, eucalyptol, safrol, methyl salicylate, menthyl lactate, menthyl ethoxyacetate, menthone glycerinacetal, 3-l-menthoxypropane-1,2-diol, ethyl l-menthyl carbonate, (1S,3S,4R)-p-menth-8-en-3-ol, menthyl pyrrolidone carboxylate, N-ethyl-p-menthane-3-carboxamide, N,2,3-trimethyl-2-isopropylbutanamide and l-menthon-ld-isomenthon glycerin ketal.

Techniques for formulation and administration of drugs may be found in "Remington's Pharmaceutical Sciences," Mack Publishing Co., Easton, PA, latest edition, which is incorporated herein by reference.

Examples of formulations for topical administration include, but are not limited to a powder, a gel, a soap, a cream, an ointment, a paste, a lotion, a wand (stick), a roll-on, a milk, a suspension, an aerosol, a spray, a foam and a serum.

Deodorants of the present invention may be manufactured by processes well known in the art, e.g., by means of conventional mixing, dissolving, granulating, dragee-making, levigating, emulsifying, encapsulating, entrapping or lyophilizing processes.

The deodorants of the present invention are preferably formulated so as to prevent the bacteriophages within to penetrate the outer skin layer. Further, the compositions of the present invention are preferably formulated so as to allow the bacteriophages within to propagate in the presence of odor-generating bacteria.

Determination of an effective amount is well within the capability of those skilled in the art, especially in light of the detailed disclosure provided herein.

Smell tests may be used to analyze the effectiveness of a particular deodorant. For example a panel of people comprising a significant number and cross-section of people blindly smells clothes of a subject who has applied the deodorant. The results are statistically analyzed using *parametric* or *non-parametric* methods. In order to eliminate the influence of the difference among individual panelists and their physical conditions, in vitro and automated systems are also available to measure smell. Such systems are available from companies such as Odotech Inc.

For any preparation used in the methods of the invention, the effective amount or dose can be estimated initially from in vitro and cell culture assays. For example, a

dose can be formulated in animal models to achieve a desired concentration or titer. Such information can be used to more accurately determine useful doses in humans.

Toxicity and therapeutic efficacy of the active ingredients described herein can be determined by standard pharmaceutical procedures in vitro, in cell cultures or experimental animals. The data obtained from these in vitro and cell culture assays and animal studies can be used in formulating a range of dosage for use in human. The dosage may vary depending upon the dosage form employed and the route of administration utilized. The exact formulation, route of administration and dosage can be chosen by the individual physician in view of the patient's condition. (See e.g., Fingl, et al., 1975, in "The Pharmacological Basis of Therapeutics", Ch. 1 p.1).

Depending on the severity of the body odor, dosing can be of a single or a plurality of applications.

The amount of deodorant to be administered will, of course, be dependent on the subject being treated, the severity of the affliction, the manner of administration, the judgment of the prescribing physician, etc.

According to one embodiment, a single application of the compositions of the present invention allows about 10^2 to 10^3 PFU/ml of bacteriophages per cm^2 of skin. It will be appreciated that the amount of bacteriophages changes following application depending on the number of odor-generating bacteria present on the surface of the skin.

As used herein the term “about” refers to ± 10.

The terms "comprises", "comprising", "includes", "including", “having” and their conjugates mean "including but not limited to".

The term “consisting of means “including and limited to”.

The term "consisting essentially of" means that the composition, method or structure may include additional ingredients, steps and/or parts, but only if the additional ingredients, steps and/or parts do not materially alter the basic and novel characteristics of the claimed composition, method or structure.

As used herein, the singular form "a", "an" and "the" include plural references unless the context clearly dictates otherwise. For example, the term "a compound" or "at least one compound" may include a plurality of compounds, including mixtures thereof.

Throughout this application, various embodiments of this invention may be presented in a range format. It should be understood that the description in range format is merely for convenience and brevity and should not be construed as an inflexible limitation on the scope of the invention. Accordingly, the description of a range should be considered to have specifically disclosed all the possible subranges as well as individual numerical values within that range. For example, description of a range such as from 1 to 6 should be considered to have specifically disclosed subranges such as from 1 to 3, from 1 to 4, from 1 to 5, from 2 to 4, from 2 to 6, from 3 to 6 etc., as well as individual numbers within that range, for example, 1, 2, 3, 4, 5, and 6. This applies regardless of the breadth of the range.

Whenever a numerical range is indicated herein, it is meant to include any cited numeral (fractional or integral) within the indicated range. The phrases "ranging/ranges between" a first indicate number and a second indicate number and "ranging/ranges from" a first indicate number "to" a second indicate number are used herein interchangeably and are meant to include the first and second indicated numbers and all the fractional and integral numerals therebetween.

As used herein the term "method" refers to manners, means, techniques and procedures for accomplishing a given task including, but not limited to, those manners, means, techniques and procedures either known to, or readily developed from known manners, means, techniques and procedures by practitioners of the chemical, pharmacological, biological, biochemical and medical arts.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination or as suitable in any other described embodiment of the invention. Certain features described in the context of various embodiments are not to be considered essential features of those embodiments, unless the embodiment is inoperative without those elements.

Although the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all

such alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims.

All publications, patents and patent applications mentioned in this specification are herein incorporated in their entirety by reference into the specification, to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated herein by reference. In addition, citation or identification of any reference in this application shall not be construed as an admission that such reference is available as prior art to the present invention. To the extent that section headings are used, they should not be construed as necessarily limiting.

WHAT IS CLAIMED IS:

1. A method of controlling body odor in a subject in need thereof, the method comprising topically administering to the subject an effective amount of at least one species of a lytic bacteriophage capable of killing an odor-generating bacteria, thereby controlling the body odor.

2. The method of claim 1, wherein said odor-generating bacteria are under-arm odor generating bacteria.

3. The method of claim 1, wherein said odor-generating bacteria are foot odor generating bacteria.

4. The method of claim 1, wherein said odor-generating bacteria are capable of generating iso-valeric acid.

5. The method of claim 1, wherein said odor generating bacteria is of a genus selected from the group consisting of a *Staphylococcus*, a *Propionibacteria*, a *Bacillus* and a *Corynebacterium*.

6. The method of claim 2, wherein said under-arm odor generating bacteria are selected from the group consisting of *C. jeikeium, C. Striatum, C. Bovis, C. Xerosis, C. Tuberculostearicum, C. Minutissimum, S. Epidermidis, S. Haemolyticus* and *Bacillus licheniformis*.

7. The method of claim 3, wherein said foot odor generating bacteria are selected from the group consisting of *Bacillus subtilis, P. avidum, S. epidermidis, S. hominis* and *Corynebacterium sp.*

8. The method of claim 3, wherein said foot odor generating bacteria is *Bacillus subtilis*.

9. The method of claim 1, wherein said at least one species of a lytic bacteriophage comprises a poly-valent bacteriophage.

10. The method of claim 1, wherein said at least one species of a lytic bacteriophage comprises a mono-valent bacteriophage.

11. A deodorant comprising as an active agent at least one species of lytic bacteriophage being capable of killing an odor-generating bacteria and a carrier, the deodorant being formulated for topical administration to a subject.

12. The deodorant of claim 11, wherein said odor-generating bacteria are under-arm odor generating bacteria.

13. The deodorant of claim 11, wherein said odor-generating bacteria are foot odor generating bacteria.

14. The deodorant of claim 11, wherein said odor-generating bacteria are capable of generating iso-valeric acid.

15. The deodorant of claim 11, wherein said odor generating bacteria is of a genus selected from the group consisting of a *Staphylococcus*, a *Propionibacteria*, a *Bacillus* and a *Corynebacterium*.

16. The deodorant of claim 12, wherein said under-arm odor generating bacteria are selected from the group consisting of *C. jeikeium, C. striatum, C. bovis, C. xerosis, C. tuberculostearicum, C. minutissimum, S. epidermidis, S. haemolyticus* and *Bacillus licheniformis*.

17. The deodorant of claim 13, wherein said foot odor generating bacteria are selected from the group consisting of *Bacillus subtilis, P. avidum, S. Epidermidis, S. Hominis* and *Corynebacterium sp.*

18. The deodorant of claim 17, wherein said foot odor generating bacteria is *Bacillus subtilis*.

19. The deodorant of claim 11, wherein said at least one species of a lytic bacteriophage comprises at least one species of a poly-valent bacteriophage.

20. The deodorant of claim 11, wherein said at least one species of a lytic bacteriophage comprises at least one species of a mono-valent bacteriophage.

21. The deodorant of claim 11, being formulated as a formulation selected from the group consisting of a spray, a cream, a gel, a stick and a powder.

22. The deodorant of claim 11, further comprising a perfume.

23. The deodorant of claim 11, further comprising an agent which promotes diffusion of said at least one species of lytic bacteriophages.

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2009/000157

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K8/99 A61Q15/00

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 practical, 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.
X	EP 0 414 304 A2 (UNILEVER NV [NL]; UNILEVER PLC [GB]) 27 February 1991 (1991-02-27) column 4, lines 6-13; claims; example 11	1-23
A	WO 2007/007055 A1 (UNIV LEEDS [GB]; WEST DAVID [GB]; HOLLAND KEITH [GB]; BOJAR KEITH [GB]) 18 January 2007 (2007-01-18) claims 57,63 & US 2007/014770 A1 (HOLLAND KEITH [GB] ET AL) 18 January 2007 (2007-01-18) cited in the application	1,11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 July 2009	09/07/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Boeker, Ruth

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IL2009/000157

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