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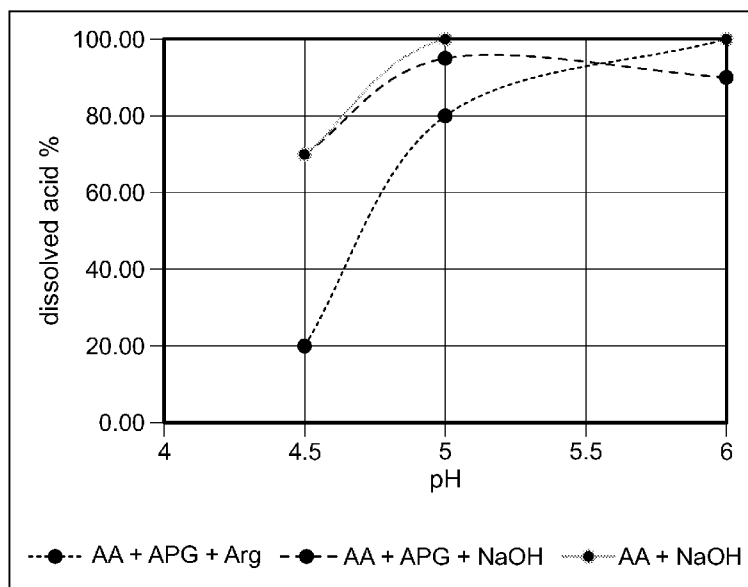


FIG. 1

(57) Abstract: The present application provides an aqueous antimicrobial composition, comprising: (a) one or more organic acids and its salts thereof; and (b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and (ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide, and/or from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids and salts thereof, also discloses a method of producing an aqueous antimicrobial composition, and its use in an end-user applications.



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**ALKYL POLYGLUCOSIDE BASED AQUEOUS ANTIMICROBIAL COMPOSITIONS****FIELD OF THE INVENTION**

**[0001]** The presently disclosed process(es), procedure(s), method(s), product(s), result(s), and/or concept(s) (collectively referred to hereinafter as the “present disclosure or invention”) relates generally to an aqueous antimicrobial composition, a method of producing an aqueous antimicrobial composition, and uses thereof. of aqueous antimicrobial composition thereof.

**BACKGROUND OF THE INVENTION**

**[0002]** The present application relates to an aqueous antimicrobial composition, a method of producing an aqueous antimicrobial composition, and, and uses thereof.

**[0003]** Antibacterial compositions are used, for example, in the health care industry, food service industry, meat processing industry, and in the private sector by individual consumers. The wide-spread use of antibacterial compositions indicates the importance consumers place on controlling bacteria and other microorganism populations on skin. It is important, however, that antibacterial compositions provide a substantial and broad spectrum reduction in microorganism populations quickly and without problems associated with toxicity and skin irritation.

**[0004]** Antimicrobial organic acids are generally soluble in water at high concentration, but some of the organic acid antimicrobial agents are not soluble in water. As an example, known to have limited solubility in water and the antimicrobial compositions of anisic acid described in prior arts are low in active even with the use of organic solvents such as glycols or suspension agents.

**[0005]** US Publication No. 20060229291A1 describes concentrated aqueous solutions of p-methoxybenzoic acid and their production.

**[0006]** European granted patent No.1325731 describes a microbicidal agent comprising anisic acid, one of its salts or one of its C<sub>1</sub>-C<sub>4</sub> alkyl esters, at least one polyol having a hydrocarbon chain which comprises at least 4 carbon atoms and which carries at least two hydroxyl groups and at least one cationic surfactant.

**[0007]** French granted patent No. 2834459 describes the use of a combination of anisic acid, a salt or an alkyl ester thereof, a polyol and a cationic surfactant as an anti-microbial agent in cosmetic formulations, in particular in hair treatment compositions such as shampoos.

[0008] PCT publication No. 2012055855 describes synergistic combinations of Ethyl Lauroyl Arginate HCl (LAE) with other preservatives, natural extracts, solvents or chelating agents with improved efficiency in anionic matrices, and better preservation ability against molds and gram negative bacteria.

[0009] *In view of the foregoing*, still there is a need for a unique antimicrobial composition having antimicrobial organic acids that are soluble in water at a high concentration for an aqueous or non-aqueous based end-user compositions for reducing, or inhibiting, or preventing microbial growth, comprising the suitable or effective amount of antimicrobial compositions in the desired end-user products.

[0010] Surprisingly, it was discovered that the solubility of one or more organic acids and salts was improved in the presence of at least one alkyl polyglucoside (APG); and with from about 1 to about 5 wt.% of sodium hydroxide or potassium hydroxide, and/or from about 0.1 to about 25 wt.% of one or more amino acids and salts thereof.

[0011] Accordingly, it is an objective of the present application to provide an aqueous antimicrobial composition, comprising: (a) one or more organic acids and salts thereof; and (b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and (ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide, and/or from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids and salts thereof.

## SUMMARY OF THE INVENTION

[0012] The primary aspect of the present application is to provide an aqueous antimicrobial composition, comprising: a) from about 5.0 wt.% to about 50.0 wt.% of one or more organic acids and salts thereof; and (b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and (ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide, and/or from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids and salts thereof.

[0013] Yet another aspect of the present application discloses that an aqueous antimicrobial composition, comprising: a) i) from about 5.0 wt.% to about 30.0 wt.% of anisic acid and salt thereof, and ii) optionally, from about 1.0 wt.% to about 30.0 wt.% of one or more organic acids selected from the group consisting of cinnamic acid, levulinic acid, benzoic acid, gluconic acid,

sorbic acid, perillic acid, phytic acid, opionic acid, lactic acid, undecylenic acid, caprylhydroxamic acid, sorbohydroxamic acid, their salts, and combinations thereof; and b) (i) from about 5.0 wt.% to about 30.0 wt.% of cocoyl glucoside, and (ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide, and from about 0.1 wt.% to about 25.0 wt.% of one or more amino acids selected from the group consisting of arginine, lysine, their salts and combinations thereof.

**[0014]** Another aspect of the present application provides a method of producing an aqueous antimicrobial composition, comprising the steps of: a) dispersing or mixing i) from about 1.0 wt.% to about 30.0 wt.% of one or more organic acids or their salts and ii) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG); b) adding and stirring from about 0.1 wt.% to about 25.0 wt.% of one or more amino acids or their salts to the resultant mixture of step (a); and c) adding from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide to the mixture of step (b) to adjust the pH between from about 7 to about 9.

**[0015]** Another aspect of the present application provides a use of the aqueous antimicrobial composition of the present application in an end-user application selected from the group consisting of personal care or cosmetic products, toiletry products, oral care products, skin care products, hair care products, household & cleaning products, soap and bath products, industrial and institutional cleaning products, disinfecting products, wound care products, sanitary products, agricultural compositions, textile products, coating products, and laundry products.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0016] **FIG. 1:** Various compositions of anisic acid and their calculated concentrations at different pH.

[0017] **FIG. 2:** Anisic acid blend 6h hydration test result.

[0018] **FIG. 3:** Sebum excretion rate.

[0019] **FIG. 4:** Accumulated sebum amount.

[0020] **FIG. 5:** Oil-control result (sebutape).

## DETAILED DESCRIPTION OF THE INVENTION

**[0021]** Before explaining at least one aspect of the disclosed and/or claimed inventive concept(s) in detail, it is to be understood that the disclosed and/or claimed inventive concept(s) is not limited in its application to the details of construction and the arrangement of the components or steps or methodologies set forth in the following description or illustrated in the drawings. The disclosed and/or claimed inventive concept(s) is capable of other aspects or of being practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting.

**[0022]** As utilized in accordance with the disclosure, the following terms, unless otherwise indicated, shall be understood to have the following meanings.

**[0023]** Unless otherwise defined herein, technical terms used in connection with the disclosed and/or claimed inventive concept(s) shall have the meanings that are commonly understood by those of ordinary skill in the art. Further, unless otherwise required by context, singular terms shall include pluralities and plural terms shall include the singular.

**[0024]** The singular forms "a," "an," and "the" include plural forms unless the context clearly dictates otherwise specified or clearly implied to the contrary by the context in which the reference is made. The term "Comprising" and "Comprises of" includes the more restrictive claims such as "Consisting essentially of" and "Consisting of".

**[0025]** For purposes of the following detailed description, other than in any operating examples, or where otherwise indicated, numbers that express, for example, quantities of ingredients used in the specification and claims are to be understood as being modified in all instances by the term "about". The numerical parameters set forth in the specification and attached claims are approximations that may vary depending upon the desired properties to be obtained in carrying out the application.

**[0026]** All percentages, parts, proportions and ratios as used herein, are by weight of the total composition, unless otherwise specified. All such weights as they pertain to listed ingredients are based on the active level and, therefore; do not include solvents or by-products that may be included in commercially available materials, unless otherwise specified.

**[0027]** All publications, articles, papers, patents, patent publications, and other references cited herein are hereby incorporated herein in their entirety for all purposes to the extent consistent with the disclosure herein.

**[0028]** The use of the term “at least one” will be understood to include one as well as any quantity more than one, including but not limited to, 1, 2, 3, 4, 5, 10, 15, 20, 30, 40, 50, 100, etc. The term “at least one” may extend up to 100 or 1000 or more depending on the term to which it is attached. In addition, the quantities of 100/1000 are not to be considered limiting as lower or higher limits may also produce satisfactory results.

**[0029]** As used herein, the words “comprising” (and any form of comprising, such as “comprise” and “comprises”), “having” (and any form of having, such as “have” and “has”), “including” (and any form of including, such as “includes” and “include”) or “containing” (and any form of containing, such as “contains” and “contain”) are inclusive or open-ended and do not exclude additional, unrecited elements or method steps.

**[0030]** The term “each independently selected from the group consisting of” means when a group appears more than once in a structure, that group may be selected independently each time it appears.

**[0031]** As used herein, the term “organic acid” refers to an organic compound having COOH functional group and the compound has antimicrobial properties.

**[0032]** As used herein, the term “antimicrobial”/“preservative” refers to a substance capable of killing or inhibiting the growth of microorganisms including but not limited to bacteria and fungi.

**[0033]** As used herein, the term “alkylpolyglucoside” refers to a class of substances constituted by a chain of ring structures from a sugar linked to each other by glucosidic linkages; the last ring of the glucosidic chain is acetalized with an alcohol.

**[0034]** The term “amino acid” refers to naturally occurring and non-natural amino acids, as well as amino acid analogs and amino acid mimetics that function in a manner similar to the naturally occurring amino acids. Amino acids can be referred to herein by either their commonly known three letter symbols or by the one-letter symbols recommended by the IUPAC-IUB Biochemical Nomenclature Commission. Nucleotides, likewise, can be referred to by their commonly accepted single-letter codes.

[0035] The term "anti-acne composition" refers to a composition that has a beneficial effect in treating or preventing acne, pimples, comedones, and combinations thereof.

[0036] The term "anti-dandruff composition", as used herein, refers to a composition that possesses an ability to inhibit the proliferation of *Malassezia furfur* (*M.furfur*), when present in a medium in an effective amount.

[0037] In a non-limiting embodiment, the present application provides an aqueous antimicrobial composition, comprising: (a) one or more organic acids and salts thereof; and (b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and (ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide, and/or from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids and salts thereof.

[0038] In another non-limiting embodiment, the present application provides an aqueous antimicrobial composition, comprising: (a) from about 5.0 wt.% to about 50.0 wt.% of one or more organic acids and salts thereof; and (b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and (ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassiumhydroxide, and/or from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids and salts thereof.

[0039] In one non-limiting embodiment, the present application relates to an aqueous antimicrobial composition, comprising: (a) from about 5.0 wt.% to about 50.0 wt.% of one or more organic acids and salts thereof; and (b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and (ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide.

[0040] In one more non-limiting embodiment, the present application relates an aqueous antimicrobial composition, comprising: (a) from about 5.0 wt.% to about 50.0 wt.% of one or more organic acids and salts thereof; and (b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and (ii) from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids and salts thereof.

[0041] In one non-limiting embodiment of the present application, the suitable organic acids including, but not limited to, anisic acid, cinnamic acid, levulinic acid, benzoic acid, gluconic acid,

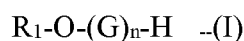
sorbic acid, perillic acid, phytic acid, opionic acid, lactic acid, undecylenic acid, caprylhydroxamic acid, sorbohydroxamic acid, their salts, and combinations thereof.

**[0042]** In another non-limiting embodiment of the present application, the amount of one or more organic acids and its salts are present in an amount from about 5.0 wt.% to about 50.0 wt.%, based on the total weight of the antimicrobial composition.

**[0043]** In another non-limiting embodiment of the present application, the organic acid is present in an amount i) from about 5.0 wt.% to about 30.0 wt.% of anisic acid and salt thereof, and ii) optionally, from about 1.0 wt.% to about 30.0 wt.% of one or more organic acids selected from the group consisting of cinnamic acid, levulinic acid, benzoic acid, gluconic acid, sorbic acid, perillic acid, phytic acid, opionic acid, lactic acid, undecylenic acid, caprylhydroxamic acid, sorbohydroxamic acid, their salts, and combinations thereof.

**[0044]** According to another non-limiting embodiment of the present application, the amount of organic acid can be varied from about 0.01 wt.% to about 0.1 wt.%; or from about 0.1 wt.% to about 1.0 wt.%; or from about 1.0 wt.% to about 2.5 wt.%; or from about 2.5 wt.% to about 5.0 wt.%; or from about 5.0 wt.% to about 10.0 wt.%; or from about 10.0 wt.% to about 15.0 wt.%; or from about 15.0 wt.% to about 20.0 wt.%; or from about 20.0 wt.% to about 25.0 wt.%; or from about 25.0 wt.% to about 30.0 wt.%; or from about 30.0 wt.% to about 35.0 wt.%; or from about 35.0 wt.% to about 40.0 wt.%; or from about 40.0 wt.% to about 45.0 wt.%; or from about 45.0 wt.% to about 50.0 wt.%, based on the total weight of the antimicrobial composition.

**[0045]** According to one embodiment of the present application, general structure of alkylpolyglucosides is represented by the formula (I) below:



wherein the radical  $R_1$  denotes a linear or branched alkyl radical comprising from about 6 to about 30 carbon atoms; wherein the group G is a glucosidic moiety; and wherein the “n” is a number ranging from about 1 to about 10.

**[0046]** In another non-limiting embodiment of the present application, the glucosidic moiety is selected from the group consisting of glucose, dextrose, saccharose, fructose, galactose, maltose, maltotriose, lactose, cellobiose, mannose, ribose, dextran, talose, allose, xylose, levoglucan, cellulose and starch.

**[0047]** In another non-limiting embodiment of the present application, the radical  $R_1$  is a linear or branched alkyl radical comprising from about 6 to about 30 carbon atoms. According to another embodiment, the number of carbon atoms ranging from about 6 to about 28 carbon atoms, from about 6 to about 24 carbon atoms, from about 6 to about 22 carbon atoms, from about 6 to about 20 carbon atoms, from about 6 to about 18 carbon atoms, from about 6 to about 16 carbon atoms, from about 6 to about 14 carbon atoms, from about 6 to about 12 carbon atoms, from about 6 to about 10 carbon atoms, from about 6 to about 8 carbon atoms.

**[0048]** In another non-limiting embodiment of the present application, the radical  $R_1$  is a linear or branched alkyl radical comprising from about 8 to about 28 carbon atoms. According to another embodiment, the number of carbon atoms ranging from about 8 to about 28 carbon atoms, from about 8 to about 26 carbon atoms, from about 8 to about 24 carbon atoms, from about 8 to about 22 carbon atoms, from about 8 to about 20 carbon atoms, from about 8 to about 18 carbon atoms, from about 8 to about 16 carbon atoms, from about 8 to about 14 carbon atoms, from about 8 to about 12 carbon atoms, or from about 8 to about 10 carbon atoms.

**[0049]** In another non-limiting embodiment of the present application, the “n” is a number from about 1 to about 10. According to another embodiment, the number is from about 1 to about 2, from about 3 to about 4, from about 5 to about 6, from about 7 to about 8, or from about 9 to about 10.

**[0050]** According to one more embodiment of the present application, the non-limiting examples of alkyl polyglucosides are selected from the group consisting of decyl glucoside, lauryl glucoside, cocoyl glucoside, and caprylyl glucoside.

**[0001]** According to another non-limiting embodiment of the present application, the amount of alkyl polyglucosides can be varied from about 0.01 wt.% to about 0.1 wt.%; or from about 0.1 wt.% to about 1.0 wt.%; or from about 1.0 wt.% to about 2.5 wt.%; or from about 2.5 wt.% to about 5.0 wt.%; or from about 5.0 wt.% to about 10.0 wt.%; or from about 10.0 wt.% to about 15.0 wt.%; or from about 15.0 wt.% to about 20.0 wt.%; or from about 20.0 wt.% to about 25.0 wt.%; or from about 25.0 wt.% to about 30.0 wt.% based on the total weight of the antimicrobial composition.

**[0002]** According to another embodiment of the present application, the amount of sodium hydroxide or potassium hydroxide is in the range of from about 1.0 wt.% to about 5.0 wt.% in total weight of antimicrobial composition.

**[0003]** According to one more embodiment of the present application, the amount of sodium hydroxide or potassium hydroxide is in the range of from about 1.0 wt.% to about 1.5 wt.%, from about 1.6 wt.% to about 2.0 wt.%, from about 2.1 wt.% to about 2.5 wt.%, from about 2.6 wt.% to about 3.0 wt.%, from about 3.1 wt.% to about 3.5 wt.%, from about 3.6 wt.% to about 4.0 wt.%, from about 4.1 wt.% to about 4.5 wt.%, or from about 4.6 wt.% to about 5.0 wt.%,

**[0004]** In another embodiment of the present application, the aqueous antimicrobial composition has a pH of from about 7 to about 9. According to another embodiment, the pH is from about 7 to about 7.5, from about 7.6 to about 8, from about 8.1 to about 8.5, or from about 8.6 to about 9.

**[0005]** In one non-limiting embodiment of the present application, the amino acid is naturally occurring and non-natural amino acids, as well as amino acid analogs and amino acid mimetics that function in a manner similar to the naturally occurring amino acids. Naturally encoded amino acids are the 20 common amino acids (alanine, arginine, asparagine, aspartic acid, cysteine, glutamine, glutamic acid, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tryptophan, tyrosine, and valine) and pyrrolysine and selenocysteine. Amino acid analogs refers to compounds that have the same basic chemical structure as a naturally occurring amino acid, i.e., an  $\alpha$  carbon that is bound to a hydrogen, a carboxyl group, an amino group, and an R group, such as, homoserine, norleucine, methionine sulfoxide, methionine methyl sulfonium. Such analogs have modified R groups (such as, norleucine) or modified peptide backbones, but retain the same basic chemical structure as a naturally occurring amino acid.

**[0006]** In another non-limiting embodiments of the present application, the amino acid is selected from the group consisting of aspartic acid, arginine, glycine, glutamic acid, proline, threonine, theanine, cysteine, cystine, alanine, valine, tyrosine, leucine, isoleucine, asparagine, serine, lysine, histidine, ornithine, methionine, carnitine, aminobutyric acid (alpha-, beta-, or gamma- isomers), glutamine, hydroxyproline, taurine, norvaline, sarcosine, and combinations thereof.

**[0007]** In another non-limiting embodiment, the amino acid is present in an amount from about 0.1 wt.% to about 30.0 wt.%.

[0008] In one more embodiment of the present application, the amino acid is present in an amount from about 0.1 wt.% to about 30.0 wt.%, from about 0.1 wt.% to about 5.0 wt.%, from about 6.0 wt.% to about 10.0 wt.%, from about 11.0 to about 15.0 wt.%, from about 16.0 wt.% to about 20.0 wt.%, from about 21.0 wt.% to about 25.0 wt.%, or from about 26.0 to about 30.0 wt.%.

[0009] The antimicrobial composition of the present application is used for inhibiting or killing *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus pneumoniae*, *Streptococcus pyogenes*, *Enterococcus faecalis*, *Haemophilus influenzae*, *Moraxella species*, *salmonella species*, *Campylobacter species*, *Pseudomonas aeruginosa*, *Clostridium botulinum*, *Clostridium perfringens*, *Corynebacteria species*, *Diplococci species*, *Mycobacteria species*, *Streptomyces species*, *Escherichia coli*, *Salmonella typhimurium*, *Salmonella enteritidis*, *Vibrio parahaemolyticus*, *Bacillus anthracis*, *Bacillus azotoformans*, *Bacillus cereus*, *Bacillus coagulans*, *Bacillus israelensis*, *Bacillus larvae*, *Bacillus mycoides*, *Bacillus polymyxa*, *Bacillus pumilis*, *Bacillus stearothermophilus*, *Bacillus subtilis*, *Bacillus thuringiensis*, *Bacillus validus*, *Bacillus weihenstephanensis*, *Bacillus pseudomycoides*, *Burkholderia cepacia*, *Burkholderia multivorans*, *Burkholderia cenocepacia*, *Burkholderia vietnamiensis*, *Burkholderia stabilis*, *Burkholderia ambifaria*, *Burkholderia dolosa*, *Burkholderia anthina*, *Burkholderia pyrrocinia*, *Candida tropicalis*, *Candida albicans*, *Hansenula anomala*, *Saccharomyces cerevisiae*, *Torulaspora delbreuckii*, *Zygosaccharomyces bailii*, *Zygosaccharomyces rouxii*, *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus brasiliensis*, *Penicillium islandicum*, *Penicillium citrinum*, *Penicillium chrysogenum*, *Fusarium oxysporum*, *Fusarium graminearum*, *Fusarium solani*, *Alternaria alternata*, and/or *Mucor racemosus*.

[0001] According to a non-limiting embodiment of the present application, the antimicrobial composition is used for killing or inhibiting the growth of *Staphylococcus aureus*, *Escherichia coli*, *Burkholderia cepacia*, *Candida albicans*, *Pseudomonas aeruginosa*, and *Aspergillus brasiliensis*.

[0010] A different embodiment of the present application discloses that the antimicrobial compositions of the present application can be formulated as an emulsion, solids, microemulsion, nanoemulsion, solution, dispersion, suspension, complex coacervate, or concentrate. Wherein, the antimicrobial compositions can also include various optional additives. Examples of the additives include, but are not limited to, colorants, pigments, plasticizers, surfactants, wetting agents, fillers,

coloring agents, dispersing agents, thickening agents, rheology modifying agents, thixotropic agents, anti-freezing agents, co-solvents, vitamins, pH modifying agents, ultraviolet light stabilizers, antioxidants, algaecides, antimicrobial agents, fragrances, buffers, hydrotropes, anti-soil agents, enzymes, suspending agents, emulsifying agent, anti-foaming agents, organic solvents, VOC-free solvents, solubilizers, and/or water-miscible solvents.

**[0011]** In one non-limiting embodiment of the present application, the vitamins are selected from the group consisting of Vitamin A, Vitamin B1, Vitamin B2, Vitamin B3, Vitamin B6, Vitamin B7, Vitamin B9, Vitamin B12, Vitamin C, Vitamin E, Vitamin K, and Vitamin D.

**[0012]** In one embodiment of the present application, the aqueous antimicrobial composition, comprising: (a) from about 5.0 wt.% to about 50.0 wt.% of one or more organic acids and salts thereof; and (b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and (ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide, and/or from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids and salts thereof.

**[0013]** In another non-limiting embodiment of the present application, the aqueous antimicrobial composition, comprising: (a) i) from about 5.0 wt.% to about 30.0 wt.% of anisic acid and salt thereof, and ii) optionally, from about 1.0 wt.% to about 30.0 wt.% of one or more organic acids selected from the group consisting of cinnamic acid, levulinic acid, benzoic acid, gluconic acid, sorbic acid, perillic acid, phytic acid, opionic acid, lactic acid, undecylenic acid, caprylhydroxamic acid, sorbohydroxamic acid, their salts, and combinations thereof; (b) (i) from about 5.0 wt.% to about 30.0 wt.% of cocoyl glucoside, and (ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide, and/or from about 0.1 wt.% to about 30.0 wt.% of one or more amino acid selected from the group consisting of arginine, lysine, their salts, and combinations thereof.

**[0014]** According to a non-limiting embodiment of the present application, it relates to a method of producing an aqueous antimicrobial composition, comprising the steps of: a) dispersing or mixing i) from about 5.0 wt.% to about 50.0 wt.% of one or more organic acid or their salts, and ii) from about 5.0 to about 30.0 wt.% of at least one alkyl polyglucoside (APG); b) adding and stirring from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids or their salts to the resultant mixture of step (a); and c) adding from about 1.0 wt.% to about 5.0 wt.% of sodium

hydroxide or potassium hydroxide to the mixture of step (b) to adjust the pH between from about 7 to about 9.

**[0015]** According to another embodiment, the present application relates to a method of killing or inhibiting the growth of bacteria and fungi, in an aqueous or non-aqueous based end-user products selected from the group consisting of personal care or cosmetic products, toiletry products, oral care products, skin care products, hair care products, household & cleaning products, soap and bath products, industrial and institutional cleaning products, disinfecting products, wound care products, sanitary products, agricultural compositions, textile products, coating products and laundry products that are susceptible to growth of microorganisms, wherein the method comprising incorporating from about 0.01 wt.% to about 10.0 wt.% of the aqueous antimicrobial composition into said products.

**[0016]** According to one more embodiment, the present application relates to the use of the aqueous antimicrobial composition in an end-user application selected from the group consisting of personal care or cosmetic products, toiletry products, oral care products, skin care products, hair care products, household & cleaning products, soap and bath products, industrial and institutional cleaning products, disinfecting products, wound care products, sanitary products, agricultural compositions, textile products, coating products, and laundry products.

**[0017]** According to another embodiment of the present application, it discloses about use of an aqueous antimicrobial composition the end-user applications are selected from the group consisting of:

- a) personal care or cosmetic products: sun care compositions, after-sun compositions, hair care compositions, conditioning compositions, skin care compositions, oral care compositions, face care compositions, lip care compositions, body care compositions, nail care compositions, anti-aging compositions, deodorant compositions, color cosmetic compositions, color-protection compositions, self-tanning compositions, foot care compositions, anti-acne compositions, anti-dandruff compositions, anti-comedones compositions and sebum control compositions;
- b) toiletry products: toilet surface cleaners
- c) animal care products: pet deodorizer, pet shampoos and pet conditioners;

- d) industrial and institutional cleaning products: hard surface cleaners, table top cleaners, vehicle cleaners, kitchen surfaces cleaners, floor cleaners, wall cleaners, window cleaners, utensil cleaners, cutlery cleaners, and crockery cleaners;
- e) wound care products: bacterial adsorbing composition and wound healing compositions;
- f) agricultural products: seed coating compositions and seed preservative compositions;
- g) textile products: dusting or disinfecting wipes;
- h) coating products: paint compositions, lacquer compositions and varnishes; and
- i) laundry products: cationic or nonionic fabric softening agents, and detergent compositions.

**[0018]** According to another embodiment, the present application relates to use of aqueous antimicrobial composition in personal care or cosmetic composition that includes, but are not limited to sun care compositions, after-sun compositions, hair care compositions, conditioning compositions, skin care compositions, oral care compositions, face care compositions, lip care compositions, body care compositions, nail care compositions, anti-aging compositions, deodorant compositions, color cosmetic compositions, color-protection compositions, self-tanning compositions and foot care compositions.

**[0019]** According to another embodiment, the present application relates to use of aqueous antimicrobial composition in personal care or cosmetic compositions that includes, anti-acne compositions, anti-dandruff composition, anti-comedones compositions, and sebum control compositions.

**[0020]** According to one more embodiment, an anti-acne composition, comprising: from about 0.5 wt.% to about 5.0 wt.% of the aqueous antimicrobial composition; and from about 0.01 wt.% to about 99.9 wt.% of one or more personal care acceptable ingredient.

**[0021]** According to another embodiment, an anti-dandruff composition, comprising: from about 0.5 wt.% to about 5.0 wt.% of the aqueous antimicrobial composition; and from about 0.01 wt.% to about 99.9 wt.% of one or more personal care acceptable ingredient.

**[0022]** According to a non-limiting embodiment of the present application, it discloses about use of claimed aqueous antimicrobial composition in an end-user compositions including but not

limited to personal care compositions is in the range of from about 0.01 wt.% to about 5.0 wt.% of the total composition.

[0023] Further, certain aspects of the present application are illustrated in detail by way of the following examples. The examples are given herein for illustration of the application and are not intended to be limiting thereof.

### EXAMPLES

[0024] **Example 1:** An antimicrobial compositions (Example 1-12) were prepared with specific amounts of each compounds as specified in Table 1.

[0025] An amount of 21.0 g of Anisic acid with 10.0 g of coco glucoside was dispersed or mixed in a 500ml of glass beaker and added 24.0 g of L-Arginine to the above mixture. The resultant mixture has a pH of 8.4.

[0026] **Table 1:** Examples with specific amount of ingredients

| Compound                   | Examples |    |    |    |      |      |    |    |    |     |     |     |
|----------------------------|----------|----|----|----|------|------|----|----|----|-----|-----|-----|
|                            | #1       | #2 | #3 | #4 | #5   | #6   | #7 | #8 | #9 | #10 | #11 | #12 |
| Anisic acid (wt.%)         | 21       | 21 | 21 | 21 | 10   | 10   | 20 | 20 | 25 | 25  | 20  | 20  |
| Sodium Levulinate (wt.%)   | -        | -  | -  | -  | -    | -    | -  | 10 | -  | -   | -   | -   |
| Coco Glucoside (wt.%)      | 10       | -  | 10 | -  | 20   | -    | 15 | 10 | -  | 5   | 5   | 10  |
| L-Arginine (wt.%)          | 24       | 24 | -  | -  | -    | -    | 14 | 24 | 10 | 10  | 10  | 24  |
| L-Lysine (wt.%)            | -        | -  | 20 | 20 | -    | -    | -  | -  | -  | -   | -   | -   |
| Water (%)                  | 45       | 55 | 49 | 59 | 67.4 | 87.3 | 49 | 30 | 46 | 31  | 42  | 42  |
| Sodium hydroxide (wt.%)    | -        | -  | -  | -  | 2.60 | 2.7  | 2  | -  | 4  | 4   | 3   | -   |
| Sodium Benzoate (wt.%)     | -        | -  | -  | -  | -    | -    | -  | -  | 15 | -   | -   | -   |
| Potassium Sorbate (%)      | -        | -  | -  | -  | -    | -    | -  | -  | -  | 25  | -   | -   |
| Potassium Cinnamate (wt.%) | -        | -  | -  | -  | -    | -    | -  | -  | -  | -   | 20  | -   |
| Ethyl Lauroyl              | -        | -  | -  | -  | -    | -    | -  | -  | -  | -   | -   | 4   |

|                        |                 |             |                 |             |                 |                     |                 |                     |                 |                 |                     |                 |
|------------------------|-----------------|-------------|-----------------|-------------|-----------------|---------------------|-----------------|---------------------|-----------------|-----------------|---------------------|-----------------|
| Arginate<br>HCl (wt.%) |                 |             |                 |             |                 |                     |                 |                     |                 |                 |                     |                 |
| pH                     | 8.4             | 7.2         | 8.3             | 7.4         | 7.7             | 8.2                 | 7.7             | 8.3                 | 7.2             | 7.3             | 7.4                 | 7.6             |
| Stability              | Transp<br>arent | Cry<br>stal | Transp<br>arent | Cry<br>stal | Transp<br>arent | Trans<br>paren<br>t | Transp<br>arent | Trans<br>paren<br>t | Transp<br>arent | Transp<br>arent | Trans<br>paren<br>t | Transp<br>arent |

[0027] The antimicrobial compositions were included in various applications as described in Table 3-7, to check the preservation challenge test and their results and were listed in Table 2.

[0028] **Table 2:** Applications of antimicrobial compositions and preservative challenge test

| Base                   | Antimicrobial<br>composition %<br>(w/w) | pH  | Microorganisms                                               | 7<br>Days | 14<br>Days | 28<br>Days | Pass/Fai<br>l |
|------------------------|-----------------------------------------|-----|--------------------------------------------------------------|-----------|------------|------------|---------------|
| Facial mask            | 0.75 of Example 1                       | 5.3 | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | -         | -          | -          | pass          |
|                        | 1.5 of Example 5                        | 5.3 | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | +         | +          | -          | pass          |
|                        | 1.5 of Example 5                        | 5.3 | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | ++        | +          | -          | pass          |
| Clinical test<br>cream | 0.75 of Example 1                       | 5   | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | -         | -          | -          | pass          |
|                        | 1.5 of Example 5                        | 5   | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | -         | -          | -          | pass          |
|                        | 1.5 of Example 5                        | 5   | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | -         | -          | -          | pass          |
| Shampoo                | 0.75 of Example 1                       | 5   | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | +         | -          | -          | pass          |
|                        | 1.5 of Example 5                        | 5   | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | ++        | ++         | -          | pass          |
|                        | 1.5 of Example 5                        | 5   | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | ++        | ++         | -          | pass          |
| Toner                  | 0.60 of Example 1                       | 5.3 | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | +         | -          | -          | pass          |
|                        | 1.2 of Example 5                        | 5.3 | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | -         | -          | -          | pass          |
|                        | 1.2 of Example 6                        | 5.3 | <i>Candida albicans</i> ,<br><i>Aspergillus brasiliensis</i> | +++       | -          | -          | pass          |

**[0029] Table 3:** Laundry detergent composition

| Ingredients                                                            | % (w/w)     |
|------------------------------------------------------------------------|-------------|
| Composition of Example 1                                               | 0.75        |
| C <sub>12</sub> -C <sub>14</sub> fatty alcohol ethoxylates, 9 moles EO | 12.0        |
| Cocamidopropylamine oxide                                              | 0.9         |
| 1-hydroxyethyl-2-undecyl-1-carboxymethyl imidazoline                   | 2.25        |
| C <sub>12</sub> -C <sub>14</sub> fatty alcohol ethoxylates, 7 moles EO | 2.0         |
| Sodium chloride                                                        | 0.3         |
| Water/Aqua                                                             | <i>q.s.</i> |
| Total                                                                  | 100         |

**[0030] Table 4:** Facial mask composition

| Ingredients                                                                                           | % (w/w)     |
|-------------------------------------------------------------------------------------------------------|-------------|
| Phase A                                                                                               |             |
| Water/Aqua                                                                                            | <i>q.s.</i> |
| Hydroxyethylcellulose                                                                                 | 0.15        |
| 1,3-Butanediol                                                                                        | 4.0         |
| Sodium hyaluronate                                                                                    | 0.03        |
| Phase B                                                                                               |             |
| Disodium EDTA                                                                                         | 0.05        |
| Glycerin (and) Glyceryl Acrylate/Acrylic Acid Copolymer (and) Propylene Glycol (and) PVM/MA Copolymer | 4.0         |
| Dipotassium Glycyrrhizate                                                                             | 0.15        |
| Allantoin                                                                                             | 0.15        |
| Phase C                                                                                               |             |
| Water (and) Glycerin (and) Ceratonia Siliqua (Carob) Seed Extract                                     | 0.2         |
| Phase D                                                                                               |             |
| Composition of Example 1                                                                              | 0.75        |
| Total                                                                                                 | 100         |

**[0031] Table 5:** Shampoo compositions

| <b>Ingredients</b>                   | <b>%<br/>(w/w)</b> |
|--------------------------------------|--------------------|
| <b>Phase A</b>                       |                    |
| Aqua                                 | q.s.               |
| Guar Hydroxypropyltrimonium Chloride | 0.15               |
| Disodium EDTA                        | 0.1                |
| Cocamidopropyl Betaine               | 6.0                |
| <b>Phase B</b>                       |                    |
| Sodium Laureth Sulfate               | 18.0               |
| Cocamide MEA                         | 1.0                |
| <b>Phase C</b>                       |                    |
| Sodium chloride                      | 0.8                |
| Composition of Example 1             | 0.75               |
| Total                                | 100                |

**[0032] Table 6:** Clinical cream composition

| <b>Ingredients</b>                                                                            | <b>% (w/w)</b> |
|-----------------------------------------------------------------------------------------------|----------------|
| <b>Phase A</b>                                                                                |                |
| Water/Aqua                                                                                    | q.s.           |
| Disodium EDTA                                                                                 | 0.05           |
| Water/Aqua (and) Glycerin (and) Glyceryl Acrylate/Acrylic Acid Copolymer (and) Phenoxyethanol | 3.0            |
| <b>Phase B</b>                                                                                |                |
| Acrylic Acid/VP Crosspolymer                                                                  | 0.6            |
| <b>Phase C</b>                                                                                |                |
| Sodium Hydroxide                                                                              | 0.2            |
| <b>Phase D</b>                                                                                |                |
| Stearyl Dimethicone                                                                           | 2.0            |
| PEG-100 Stearate (and) Glyceryl Stearate                                                      | 2.0            |
| Butyrospermum Parkii (Shea) Butter                                                            | 2.0            |
| Cetyl Lactate                                                                                 | 1.5            |
| Octyldodecyl Stearate                                                                         | 5.0            |
| Ethylhexyl Palmitate                                                                          | 4.0            |
| <b>Phase E</b>                                                                                |                |
| Sodium Hydroxide                                                                              | 0.5            |
| composition of Example 1                                                                      | 0.75           |
| Total                                                                                         | 100            |

**[0033] Table 7:** Toner composition

| Ingredients                                                                                              | % (w/w) |
|----------------------------------------------------------------------------------------------------------|---------|
| water                                                                                                    | q.s.    |
| Carbomer                                                                                                 | 0.1     |
| Glycerin (and) Glyceryl Acrylate/Acrylic Acid Copolymer (and)<br>Propylene Glycol (and) PVM/MA Copolymer | 3.0     |
| Sodium Hydroxide                                                                                         | 0.3     |
| Composition of Example 1                                                                                 | 0.6     |
| Total                                                                                                    | 100     |

**[0034] Preservative challenge test:**

**[0035]** Table 8 and Table 9 demonstrates activity of Mold and Yeast. The test was based on the European Pharmacopoeia and was performed to determine the preserving effect of chemical preservatives in cosmetic formulations. In separated batches different concentrations of the test preservatives were added to the unpreserved samples. There was a single inoculation of the test batches with yeast and mold suspension. Simultaneously streak cultures of each batch were made right before inoculation. After inoculation the germ count was expected to decrease over time. The final assessment is performed in accordance to Ph. Eur. The sample is initially inoculated with a yeast (*Candida albicans*) and mold (*Aspergillus niger*) suspension (titre  $10^7$  cfu/ml) and were streaked on sabouraud-dextrose-agar plates with neutralizer (polysorbate, lecithin, saponine, histidine) after 7, 14, 21 and 28 days. After three days of incubation at  $25 \pm 2^\circ\text{C}$  the fungal growth of the streak cultures were evaluated. The microbial growth of the streaks was assessed semi-quantitatively to determine sufficient preservation of the various products.

**[0036] Table 8:** Preservatives challenge test against Mold and Yeast in facial mask formulation

| Pure active calculated       | pH   | Microbes                | 7D   | 14 D | 21D  | 28 D |
|------------------------------|------|-------------------------|------|------|------|------|
| 0.1% anisic acid+0.1%APG0810 | 5.41 | Mold                    | C    | ++++ | ++++ | ++++ |
|                              |      | <i>Candida albicans</i> | ++++ | +    | -    | -    |
| 0.1% anisic acid+0.2%APG0810 | 5.42 | Mold                    | C    | ++++ | ++++ | ++++ |
|                              |      | <i>Candida albicans</i> | ++++ | -    | -    | -    |
| 0.2% anisic acid+0.1%APG0810 | 5.45 | Mold                    | ++++ | +++  | +++  | +++  |
|                              |      | <i>Candida albicans</i> | +++  | +    | -    | -    |
| 0.2% anisic acid+0.2%APG0810 | 5.43 | Mold                    | ++++ | ++   | +++  | +++  |
|                              |      | <i>Candida albicans</i> | +++  | -    | -    | -    |
| No preservative              | 5.39 | Mold                    | C    | C    | C    | C    |
|                              |      | <i>Candida albicans</i> | ++++ | ++++ | ++++ | ++++ |

**Assessment:**

- free of growth (ca.  $<10^2$  cfu/ml)
  - + slight growth (ca.  $10^2$  cfu/ml)
  - ++ moderate growth (ca.  $10^3$  cfu/ml)
  - +++ heavy growth (ca.  $10^4$  cfu/ml)
  - ++++ massive growth (ca.  $10^5$  cfu/ml)
  - C completely overgrown (ca.  $10^6$  cfu/ml)
- APG0810 Capryl/Caprylyl Glucoside

**[0037] Table 9: Preservatives challenge test against Mold and Yeast in facial mask formulation**

| Pure active calculated               | pH   | Microbes | 7D   | 14 D | 21D  | 28 D |
|--------------------------------------|------|----------|------|------|------|------|
| 0.1% anisic acid+0.1% coco glucoside | 5.38 | Mold     | C    | ++++ | ++++ | ++++ |
|                                      |      | Yeast    | +++  | +    | -    | -    |
| 0.1% anisic acid+0.2% coco glucoside | 5.38 | Mold     | C    | ++++ | ++++ | ++++ |
|                                      |      | Yeast    | +++  | -    | -    | -    |
| 0.2% anisic acid+0.1% coco glucoside | 5.41 | Mold     | ++++ | ++   | +++  | ++   |
|                                      |      | Yeast    | +++  | -    | -    | -    |
| 0.2% anisic acid+0.2% coco glucoside | 5.43 | Mold     | ++++ | ++   | +++  | +++  |
|                                      |      | Yeast    | +++  | -    | -    | -    |
| No preservative                      | 5.39 | Mold     | C    | C    | C    | C    |
|                                      |      | Yeast    | ++++ | ++++ | ++++ | ++++ |

**[0038]** Boosting effect against fungi was tested and the results indicates that more APG give better efficacy. Further, APG with long carbon chain lengths have better boosting efficacy.

**[0039] Table 10: The Time-kill kinetics assay against *E. coli* (Hexanediol)**

| Anti <i>E.coli</i>                                       | 3h   | 6h   | 12h  | 24h  |
|----------------------------------------------------------|------|------|------|------|
| 0.8% Hexanediol                                          | C    | C    | C    | C    |
| 0.8% Hexanediol +0.2% Hexyl Glucoside                    | C    | C    | C    | ++++ |
| 0.8% Hexanediol +0.2% Isooctyl Glucoside                 | C    | C    | C    | ++++ |
| 0.8% Hexanediol +0.2% Decyl Glucoside                    | C    | C    | C    | ++++ |
| 0.8% Hexanediol +0.2% Capryl/Caprylyl Glucoside          | ++++ | ++++ | +++  | ++   |
| 0.8% Hexanediol +0.2% Coco Glucoside                     | C    | C    | ++++ | ++++ |
| 0.8% Hexanediol +0.2% Lauryl Glucoside or Coco Glucoside | C    | C    | ++++ | ++++ |
| 0.8% Hexanediol +0.2% Coco Glucoside                     | C    | ++++ | ++++ | ++++ |

[0040] The Table 10 showed APG can boost hexanediol, accelerates killing rate of preservatives.

[0041] The time-kill kinetics assay method was explained below:

[0042] The test was used to study the activity of an antimicrobial agent against a microorganism strain and can determine the antimicrobial activity of an agent over time. The samples were mixed with different concentrations of the preservatives. For each test germs the samples were inoculated with the germ suspensions (titre  $10^7$  cfu/ml) and stirred thoroughly after exposure times 3, 6, 12 and 24h the samples are streaked on sabouraud-dextrose-agar plates with neutralizer (polysobate, lecithin, saponine, histidine).

[0043] Table 11 provides boosting of Phenoxyethanol (wt%) with APG (wt%) and indicates accelerated killing rate of preservatives.

[0044] The time-kill kinetics assay method is explained in below: The test was used to study the activity of an antimicrobial agent against a microorganism strain and can determine the antimicrobial activity of an agent over time. The samples were mixed with different concentrations of the preservatives. For each test germs the samples were inoculated with the germ suspensions (titre  $10^7$  cfu/ml) and stirred thoroughly after exposure times 3, 6, 12 and 24h the samples were streaked on sabouraud-dextrose-agar plates with neutralizer (polysobate, lecithin, saponine, histidine).

[0045] **Table 11:** The Time-kill kinetics assay against E. coli (Phenoxyethanol)

| Anti E.coli                                         | 3h  | 6h  | 12h | 24h |
|-----------------------------------------------------|-----|-----|-----|-----|
| 0.5% Phenoxyethanol                                 | C   | C   | C   | C   |
| 0.5% Phenoxyethanol +0.2% Hexyl Glucoside           | C   | C   | C   | C   |
| 0.5% Phenoxyethanol +0.2% Isooctyl Glucoside        | C   | C   | C   | C   |
| 0.5% Phenoxyethanol +0.2% Decyl Glucoside           | +   | -   | -   | -   |
| 0.5% Phenoxyethanol +0.2% Capryl/Caprylyl Glucoside | +   | -   | -   | -   |
| 0.5% Phenoxyethanol +0.2% Coco Glucoside            | +++ | +++ | +   | +   |
| 0.5% Phenoxyethanol +0.2% Lauryl Glucoside          | +++ | +++ | -   | -   |
| 0.5% Phenoxyethanol +0.2% Coco Glucoside            | +++ | +++ | ++  | +   |

**[0046] Solubility:**

**[0047]** An aqueous solution of anisic acid was prepared and the solution was adjusted to make solutions (Examples 13-21) of different pH values. The solutions were centrifuged at 4000 rpm for 10 min. The supernatant of the liquid, with 100 times dilution, was scanned at UV frequency of 200-400 nm and recorded the data and calculated the concentration as given in Table 12 and FIG 1. At different pH values, the solubility of anisic acid in aqueous solutions was different. It was observed that anisic acid in arginine solution was precipitated out more than sodium salt at low pH, so the anisic acid molecule will have higher concentration in solution which led to better anti-bacterial efficacy.

**[0048] Table 12:** Solubility of samples

| Example | Water solution (wt%)                                      | pH Values | Calculated Concentration |
|---------|-----------------------------------------------------------|-----------|--------------------------|
| 13#     | 0.2% anisic acid + 0.2% cocoyl glucoside + 0.24% Arginine | pH 6      | 0.20%                    |
| 16#     | 0.2% anisic acid + 0.2% cocoyl glucoside + 0.0536% NaOH   | pH 6      | 0.18%                    |
| 19#     | 0.2% anisic acid + 0.0536% NaOH                           | pH 6      | 0.20%                    |
| 14#     | 0.2% anisic acid + 0.2% cocoyl glucoside + 0.24% Arginine | pH 5      | 0.16%                    |
| 17#     | 0.2% anisic acid + 0.2% cocoyl glucoside + 0.0536% NaOH   | pH 5      | 0.19%                    |
| 20#     | 0.2% anisic acid + 0.0536% NaOH                           | pH 5      | 0.20%                    |
| 15#     | 0.2% anisic acid + 0.2% cocoyl glucoside + 0.24% Arginine | pH 4.5    | 0.04%                    |
| 18#     | 0.2% anisic acid + 0.2% cocoyl glucoside + 0.0536% NaOH   | pH 4.5    | 0.14%                    |
| 21#     | 0.2% anisic acid + 0.0536% NaOH                           | pH 4.5    | 0.14%                    |

**[0049] HET-CAM test:**

**[0050]** HET-CAM test was performed as per the protocol described by Spielmann and Liebsch (INVITTOX 1992). The irritation score was measured by using below formula. The results were listed in Table 13.

$$\text{Irritation Score (IS)} = \left( \left( \frac{301\text{-Hemorrhage time}}{300} \right) \times 5 \right) + \left( \left( \frac{301\text{-Lysis time}}{300} \right) \times 7 \right) + \left( \left( \frac{301\text{-Coagulation time}}{300} \right) \times 9 \right)$$

**Hemorrhage time** = observed start (in seconds) of hemorrhage reactions on CAM;

**Lysis time** = Observed start (in seconds) of vessel lysis in CAM; and

**Coagulation time** = Observed start (in seconds) of coagulation formation in CAM.

**[0051] Table 13:** Irritation evaluation result of CAM experiment

| Product          | Sample Name (wt%)      | IS Score* |      |      |         | Irritation Classification |
|------------------|------------------------|-----------|------|------|---------|---------------------------|
|                  |                        | 1st       | 2nd  | 3rd  | Average |                           |
| Test Products    | 0.1% Salicylic acid    | 0.00      | 0.00 | 0.00 | 0.00    | No irritation             |
|                  | 0.3% Salicylic acid    | 0.26      | 2.96 | 3.17 | 2.13    | Slight irritation         |
|                  | 0.5% anisic acid blend | 1.38      | 0.00 | 0.00 | 0.46    | No irritation             |
|                  | 1.5% anisic acid blend | 1.26      | 0.00 | 0.00 | 0.42    | No irritation             |
|                  | 0.1% anisic acid       | 0.00      | 0.00 | 0.00 | 0.00    | No irritation             |
|                  | 0.3% anisic acid       | 0.00      | 0.00 | 0.00 | 0.00    | No irritation             |
| Negative Control | 0.9%wt NaCl            | 0.00      | /    | /    | 0.00    | No irritation             |
| Positive Control | 0.1M NaOH              | 18.46     | /    | /    | 18.46   | Strong Irritation         |

**IS score\*:** IS<1 No irritation; 1≤IS<5 Slight irritation; 5 ≤IS<9 Moderate irritation; IS ≥10 Strong irritation.

**[0052] Efficacy of anisic acid blend against *M. furfur*:**

**[0053]** 0.1ml of the *M. furfur* suspension of ( $10^6$  cfu/ml) in 5 mL shampoo was dipped with 1.5% anisic acid blend and 0.3% salicylic acid; the samples were kept at Room Temperature (RT) for 24h/48h/72h/7d. Sampling and enumeration with neutralizer (polysorbate, lecithin, saponine, histidine); determine the number of *M. furfur* in formulation after different contact time points. The results, of Table 14, confirmed that anisic acid blend provides better efficacy against *M. furfur* at 1.5% in shampoo.

**[0054] Table 14:** Efficacy of anisic acid blend against *M. furfur*

| Sample Information (wt%) | pH   | 24 h        | 48 h        | 72 h        | 7 d         |
|--------------------------|------|-------------|-------------|-------------|-------------|
| Blank shampoo            | 5.47 | 5.78 ± 0.05 | 5.61 ± 0.14 | 5.53 ± 0.04 | 4.76 ± 0.08 |
| 1.5% anisic acid blend   | 5.47 | 5.54 ± 0.04 | 4.72 ± 0.04 | 2.99 ± 0.09 | < 2.18      |
| 0.3% salicylic acid      | 5.46 | 3.41 ± 0.02 | 2.22 ± 0.19 | < 2.18      | < 2.18      |

**[0055] Efficacy of anisic acid blend against *M. restricta*:**

**[0056]** 0.1ml of the *M. restricta* suspension of ( $10^6$  cfu/ml) in 5 mL shampoo was dipped with 1.5% anisic acid blend, further with 0.3% salicylic acid; the samples were kept at Room Temperature (RT) for 24h/48h/72h/7d, count the number. Sampling and enumeration with neutralizer (polysobate, lecithin, saponine, histidine); determine the number of *M. restricta* in formulation after different contact time points. The results, of Table 15, confirmed that anisic acid blend provides better efficacy against *M. restricta* at 1.5% in shampoo.

**[0057]** **Table 15:** Efficacy of anisic acid blend against *M. restricta*

| Sample Information (wt%) | pH   | 24 h            | 48 h            | 72 h            | 7 d             |
|--------------------------|------|-----------------|-----------------|-----------------|-----------------|
| Blank shampoo            | 5.47 | $5.41 \pm 0.03$ | $5.44 \pm 0.03$ | $5.22 \pm 0.05$ | $5.09 \pm 0.02$ |
| 1.5% anisic acid blend   | 5.47 | $5.18 \pm 0.04$ | $4.97 \pm 0.04$ | $2.56 \pm 0.08$ | < 2.18          |
| 0.3% salicylic acid      | 5.46 | $3.77 \pm 0.23$ | $3.11 \pm 0.25$ | $2.81 \pm 0.04$ | < 2.18          |

**[0058]** **Efficacy of anisic acid blend against *P. acnes*:**

**[0059]** 0.1ml of the *Propionibacterium acnes* suspension of ( $10^6$  cfu/ml) was dipped in 2 mL toner with 1.5% anisic acid (AA) blend and 0.3% salicylic acid. The samples were kept at RT for 6h/24h/48h, and count the number. Sampling and enumeration with neutralizer (polysobate, lecithin, saponine, histidine); determine the number of *P. acnes* in formulation after different contact time points. The results were indicated in Table 16.

**[0060]** **Table 16:** Efficacy of anisic acid blend against *P. acnes*

| Sample Information (wt%) | pH   | 6 h             | 24 h            | 48 h            |
|--------------------------|------|-----------------|-----------------|-----------------|
| Blank toner              | 5.5  | $5.28 \pm 0.02$ | $4.78 \pm 0.06$ | $3.54 \pm 0.01$ |
| 1.5% anisic acid Blend   | 5.55 | $4.55 \pm 0.04$ | $2.47 \pm 0.09$ | <2.18           |
| 0.3% salicylic acid      | 5.55 | $3.95 \pm 0.03$ | <2.18           | <2.18           |

**[0061]** **Clinical studies:**

**[0062]** Clinical study was performed for 20 selected Asian people (10 female and 10 male, average age:  $38.8 \pm 5.8$ ). The selected criteria are that people with oily skin and the initial

Sebumeter value on the forehead exceed 120 for male and exceed 100 for female. Both male and female by applying the product at a dose of  $2\text{mg}/\text{cm}^2$ . Using double-blind test.

**[0063] Hydration test:**

**[0064]** Two zones of 2.5cm X 5cm on left or right volar forearms were chosen randomly and were treated with two test samples as per randomization. The test was performed at 0, 1, 3 and 6 hours (T0(baseline), T1h, T3h, T6h hours). The results were depicted in FIG. 4.

**[0065] Oil control test:**

**[0066]** Two symmetrical zones of 3cm X 3cm on left and right forehead were chosen and treated with two test samples as per randomization. The test was performed at 0, 1, 3 and 6 hours (T0(baseline), T1h, T3h, T6h hours).

**[0067]** Two symmetrical zones of 3cmX3cm on left and right cheek were chosen and were treated with two test samples as per randomization.

**[0068] Measurement:**

**[0069]** Sebumeter was used for skin sebum test.

**[0070]** Sebutape was used for skin sebum test at T1h.

**[0071]** Corneometer CM825 was used for skin hydration test.

**[0072] Statistical analysis:**

**[0073]** Student's T test (one-tailed) or Wilcoxon signed rank test (one-tailed) were used depending on whether the data were normally distributed. According to whether the two groups of data conform to the normal distribution, Student's T test is used for those that are consistent and the use of Wilcoxon signed rank test for that do not conform. In every graph, not only student's T test but also can use Wilcoxon signed rank test.

**[0074] Table 17:** Efficacy of anisic acid blend against *P. acnes*

| Sample                       | A             | B                                |
|------------------------------|---------------|----------------------------------|
|                              | placebo (wt%) | 1.5% anisic acid blend gel (wt%) |
| <b>Phase A</b>               |               |                                  |
| Water                        | To 100        | To 100                           |
| Stabileze® QM                | 0.5           | 0.5                              |
| <b>Phase B</b>               |               |                                  |
| NaOH (10% aqueous solution)  | 1.15          | 1.15                             |
| <b>Phase C</b>               |               |                                  |
| Liquid Germall® Plus         | 0.6           | 0.6                              |
| <b>Phase D</b>               |               |                                  |
| anisic acid blend (AA blend) | /             | 1.5                              |
|                              | pH=6.27       | pH=6.16                          |

**[0075]** The hydration test results were measured using a Corneometer and the results summarized in Table 18 and FIG. 2.

**[0076] Table 18:** Hydration test result

| Sample (wt%)  | Time   | Average | ± sem | P      | % change | % of volunteers improved |
|---------------|--------|---------|-------|--------|----------|--------------------------|
| placebo       | T2h-T0 | 0.1     | 0.65  | 0.0767 | 771%     | 65%                      |
| 1.5% AA blend |        | 0.83    | 0.59  |        |          |                          |
| placebo       | T4h-T0 | 1.02    | 0.5   | 0.0279 | 82%      | 65%                      |
| 1.5% AA blend |        | 1.86    | 0.49  |        |          |                          |
| placebo       | T6h-T0 | 1.32    | 0.64  | 0.1618 | 38%      | 65%                      |
| 1.5% AA blend |        | 1.83    | 0.54  |        |          |                          |

**[0077]** It was observed that there was a directional difference at T2h and a significant difference at T4h when compared with placebo. But no significance at 6h. It is suggested 1.5% anisic acid blend has moisturizing effect, lasting for 4h.

**[0078] Table 19: Oil-control result (Sebumeter)**

| Sample (wt%)  | Time   | Average | ± sem | P      | % change | % of volunteers improved |
|---------------|--------|---------|-------|--------|----------|--------------------------|
| placebo       | T1h-T0 | 57.75   | 8.46  | 0.0959 | -8.57%   | 60%                      |
| 1.5% AA blend |        | 52.8    | 9.2   |        |          |                          |
| placebo       | T3h-T0 | 96.7    | 11.42 | 0.2389 | -3.77%   | 55%                      |
| 1.5% AA blend |        | 93.05   | 10.89 |        |          |                          |
| placebo       | T6h-T0 | 133.35  | 10.34 | 0.0734 | -6.26%   | 60%                      |
| 1.5% AA blend |        | 125     | 11.37 |        |          |                          |

**[0079]** The sample was added with 1.5% AA blend has directional difference at 1h and 6h when compared with the placebo. The results indicated that an unexpected results (FIG. 3 and Table 19) of oil-control effect by anisic acid blend.

**[0080] Table 20: oil-control result (sebupape)**

| Sample (wt%)      | Time   | Average of total sebum spot area | ± sem   | P      | % change | % of volunteers improved |
|-------------------|--------|----------------------------------|---------|--------|----------|--------------------------|
| placebo           | T1h-T0 | 12303.03                         | 2076.35 | 0.0077 | -13.10%  | 75%                      |
| 1.5% AA blend gel |        | 10690.65                         | 1907.68 |        |          |                          |

**[0081]** As shown in the FIG. 4, FIG. 5 and Table 20, sample were added with 1.5% anisic acid blend shown significant reduction of accumulated sebum secreted by active sebaceous glands. It suggests that 1.5% anisic acid has good oil-control effect.

**[0082]** While the compositions and methods of the disclosed and/or claimed inventive concept(s) have been described in terms of particular aspects, it will be apparent to those of ordinary skill in the art that variations may be applied to the compositions and/or methods and in the steps or in the sequence of steps of the method described herein without departing from the concept, spirit and scope of the disclosed and/or claimed inventive concept(s). All such similar substitutes and modifications apparent to those skilled in the art are deemed to be within the spirit, scope and concept of the disclosed and/or claimed inventive concept(s).

*What is claimed is:*

1. An aqueous antimicrobial composition, comprising:
  - a) from about 5.0 wt.% to about 50.0 wt.% of one or more organic acids and salts thereof; and
  - b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and  
(ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide, and/or from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids and salts thereof.
2. An aqueous antimicrobial composition, comprising:
  - a) from about 5.0 wt.% to about 50.0 wt.% of one or more organic acids and salts thereof; and
  - b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and  
(ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide, and from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids and salts thereof.
3. An aqueous antimicrobial composition, comprising:
  - a) from about 5.0 wt.% to about 50.0 wt.% of one or more organic acids and salts thereof; and
  - b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and  
(ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide.
4. An aqueous antimicrobial composition, comprising:
  - a) from about 5.0 wt.% to about 50.0 wt.% of one or more organic acids and salts thereof; and
  - b) (i) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG), and

(ii) from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids and salts thereof.

5. The aqueous antimicrobial composition according to claim 1, wherein the organic acid and its salt is selected from the group consisting of anisic acid, cinnamic acid, levulinic acid, benzoic acid, gluconic acid, sorbic acid, perillic acid, phytic acid, opionic acid, lactic acid, undecylenic acid, caprylhydroxamic acid, sorbohydroxamic acid, and combinations thereof.

6. The aqueous antimicrobial composition according to claim 1, wherein the alkyl polyglucoside is having a formula (I) of:



wherein the radical  $R_1$  denotes a linear or branched alkyl radical comprising from about 6 to about 30 carbon atoms; wherein the group G is a glucosidic moiety; and wherein the “n” is a number ranging from about 1 to about 10.

7. The aqueous antimicrobial composition according to claim 6, wherein the glucosidic moiety is selected from the group consisting of glucose, dextrose, saccharose, fructose, galactose, maltose, maltotriose, lactose, cellobiose, mannose, ribose, dextran, talose, allose, xylose, levoglucan, cellulose, and starch.

8. The aqueous antimicrobial composition according to claim 6, wherein the alkyl polyglucoside is selected from the group consisting of decyl glucoside, lauryl glucoside, cocoyl glucoside, and caprylyl glucoside.

9. The aqueous antimicrobial composition according to claim 1, wherein the sodium hydroxide or potassium hydroxide is present in the range of from about 1.0 wt.% to about 5.0 wt.%.

10. The aqueous antimicrobial composition according to claim 1, wherein the amino acid is selected from the group consisting of aspartic acid, arginine, glycine, glutamic acid, proline, threonine, theanine, cysteine, cystine, alanine, valine, tyrosine, leucine, isoleucine, asparagine, serine, lysine, histidine, ornithine, methionine, carnitine, aminobutyric acid (alpha-, beta-, or

gamma- isomers), glutamine, hydroxyproline, taurine, norvaline, sarcosine, their salts and combinations thereof.

11. The aqueous antimicrobial composition according to claim 1, wherein the amino acid and its salt is present in the range of from about 0.1 wt.% to about 30.0 wt.%

12. The aqueous antimicrobial composition according to claim 1, wherein the aqueous antimicrobial composition has a pH of from about 7 to about 9.

13. The aqueous antimicrobial composition according to claim 1, wherein the composition is effective in killing or inhibiting the growth of *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus pneumoniae*, *Streptococcus pyogenes*, *Enterococcus faecalis*, *Haemophilus influenzae*, *Moraxella species*, *salmonella species*, *Campylobacter species*, *Pseudomonas aeruginosa*, *Clostridium botulinum*, *Clostridium perfringens*, *Corynebacteria species*, *Diplococci species*, *Mycobacteria species*, *Streptomyces species*, *Escherichia coli*, *Salmonella typhimurium*, *Salmonella enteritidis*, *Vibrio parahaemolyticus*, *Bacillus anthracis*, *Bacillus azotoformans*, *Bacillus cereus*, *Bacillus coagulans*, *Bacillus israelensis*, *Bacillus larvae*, *Bacillus mycoides*, *Bacillus polymyxa*, *Bacillus pumilis*, *Bacillus stearothermophilus*, *Bacillus subtilis*, *Bacillus thuringiensis*, *Bacillus validus*, *Bacillus weihenstephanensis*, *Bacillus pseudomycoides*, *Burkholderia cepacia*, *Burkholderia multivorans*, *Burkholderia cenocepacia*, *Burkholderia vietnamiensis*, *Burkholderia stabilis*, *Burkholderia ambifaria*, *Burkholderia dolosa*, *Burkholderia anthina*, *Burkholderia pyrrocinia*, *Candida tropicalis*, *Candida albicans*, *Hansenula anomala*, *Saccharomyces cerevisiae*, *Torulaspora delbreuckii*, *Zygosaccharomyces bailii*, *Zygosaccharomyces rouxii*, *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus brasiliensis*, *Penicillium islandicum*, *Penicillium citrinum*, *Penicillium chrysogenum*, *Fusarium oxysporum*, *Fusarium graminearum*, *Fusarium solani*, *Alternaria alternata* and/or *Mucor racemosus*.

14. The aqueous antimicrobial composition according to claim 1, wherein the composition is used for killing or inhibiting the growth of *Staphylococcus aureus*, *Escherichia coli*, *Burkholderia cepacia*, *Candida albicans*, *Pseudomonas aeruginosa* and *Aspergillus brasiliensis*.

15. An aqueous antimicrobial composition, comprising:

- a) i) from about 5.0 wt.% to about 30.0 wt.% of anisic acid and salt thereof, and  
ii) optionally, from about 1.0 wt.% to about 30.0 wt.% of one or more organic acids selected from the group consisting of cinnamic acid, levulinic acid, benzoic acid, gluconic acid, sorbic acid, perillic acid, phytic acid, opionic acid, lactic acid, undecylenic acid, caprylhydroxamic acid, sorbohydroxamic acid, their salts, and combinations thereof; and
- b) (i) from about 5.0 wt.% to about 30.0 wt.% of cocoyl glucoside, and  
(ii) from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide, and/or from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids selected from the group consisting of arginine, lysine, their salts, and combinations thereof;

16. A personal care composition, comprising:

- a) from about 0.01 wt.% to about 5.0 wt.% of the aqueous antimicrobial composition according to claim 1; and
- b) from about 0.01 wt.% to about 99.9 wt.% of one or more personal care acceptable ingredient.

17. The personal care composition of claim 16, wherein the personal care composition is sun care compositions, after-sun compositions, hair care compositions, conditioning compositions, skin care compositions, oral care compositions, face care compositions, lip care compositions, body care compositions, nail care compositions, anti-aging compositions, deodorant compositions, color cosmetic compositions, color-protection compositions, self-tanning compositions, foot care compositions, anti-comedones compositions, and sebum control compositions.

18. The personal care composition of claim 16, wherein the personal care acceptable ingredient is selected from the group consisting of water-insoluble ingredients, oxidizing agents, conditioning agents, humectants, pH adjusting buffers, waxes, oils, emulsifiers, fragrances, fatty substances, gelling agents, thickeners, emollients, vitamins, hydrophilic or lipophilic active agents, antioxidants, sequestering agents, acidifying or basifying agents, fragrances, fillers, dyestuffs,

plant extracts, moisturizers, proteins, peptides, neutralizing agents, solvents, anti-dandruff ingredients, reducing agents, silicones, ceraphyl esters, and combinations thereof.

19. An anti-acne composition, comprising:
  - a) from about 0.5 wt.% to about 5.0 wt.% of the aqueous antimicrobial composition according to claim 1; and
  - b) from about 0.01 wt.% to about 99.9 wt.% of one or more personal care acceptable ingredient.
20. An anti-dandruff composition, comprising:
  - a) from about 0.5 wt.% to about 5.0 wt.% of the aqueous antimicrobial composition according to claim 1; and
  - b) from about 0.01 wt.% to about 99.9 wt.% of one or more personal care acceptable ingredient.
21. A method of producing an aqueous antimicrobial composition, comprising the steps of:
  - a) dispersing or mixing i) from about 5.0 wt.% to about 50.0 wt.% of one or more organic acids or their salts, and ii) from about 5.0 wt.% to about 30.0 wt.% of at least one alkyl polyglucoside (APG);
  - b) adding and stirring from about 0.1 wt.% to about 30.0 wt.% of one or more amino acids or their salts to the resultant mixture of step (a); and
  - c) adding from about 1.0 wt.% to about 5.0 wt.% of sodium hydroxide or potassium hydroxide to the mixture of step (b) to adjust the pH between from about 7 to about 9.
22. A method of killing or inhibiting the growth of bacteria and fungi in an aqueous or non-aqueous based end-user products selected from the group consisting of personal care or cosmetic products, toiletry products, animal care products, oral care products, skin care products, hair care products, household & cleaning products, soap and bath products, industrial and institutional cleaning products, disinfecting products, wound care products, sanitary products,

agricultural compositions, textile products, coating products, and laundry products that are susceptible to growth of microorganisms comprising incorporating from about 0.01 wt.% to about 10.0 wt.% of the aqueous antimicrobial composition of claim 1 into said products.

23. Use of aqueous antimicrobial composition according to claim 1 in an end-user application selected from the group consisting of:

- a) personal care or cosmetic products: sun care compositions, after-sun compositions, hair care compositions, conditioning compositions, skin care compositions, oral care compositions, face care compositions, lip care compositions, body care compositions, nail care compositions, anti-aging compositions, deodorant compositions, color cosmetic compositions, color-protection compositions, self-tanning compositions, foot care compositions, anti-acne compositions, anti-dandruff compositions, anti-comedones compositions, and sebum control compositions;
- b) toiletry products: toilet surface cleaners;
- c) animal care products: pet deodorizer, pet shampoos and pet conditioners;
- d) industrial and institutional cleaning products: hard surface cleaners, table top cleaners, vehicle cleaners, kitchen surfaces cleaners, floor cleaners, wall cleaners, window cleaners, utensil cleaners, cutlery cleaners, and crockery cleaners;
- e) wound care products: bacterial adsorbing composition and wound healing compositions;
- f) agricultural products: seed coating compositions and seed preservative compositions;
- g) textile products: dusting or disinfecting wipes;
- h) coating products: paint compositions, lacquer compositions and varnishes; and
- i) laundry compositions: cationic or nonionic fabric softening agents, and detergent compositions.

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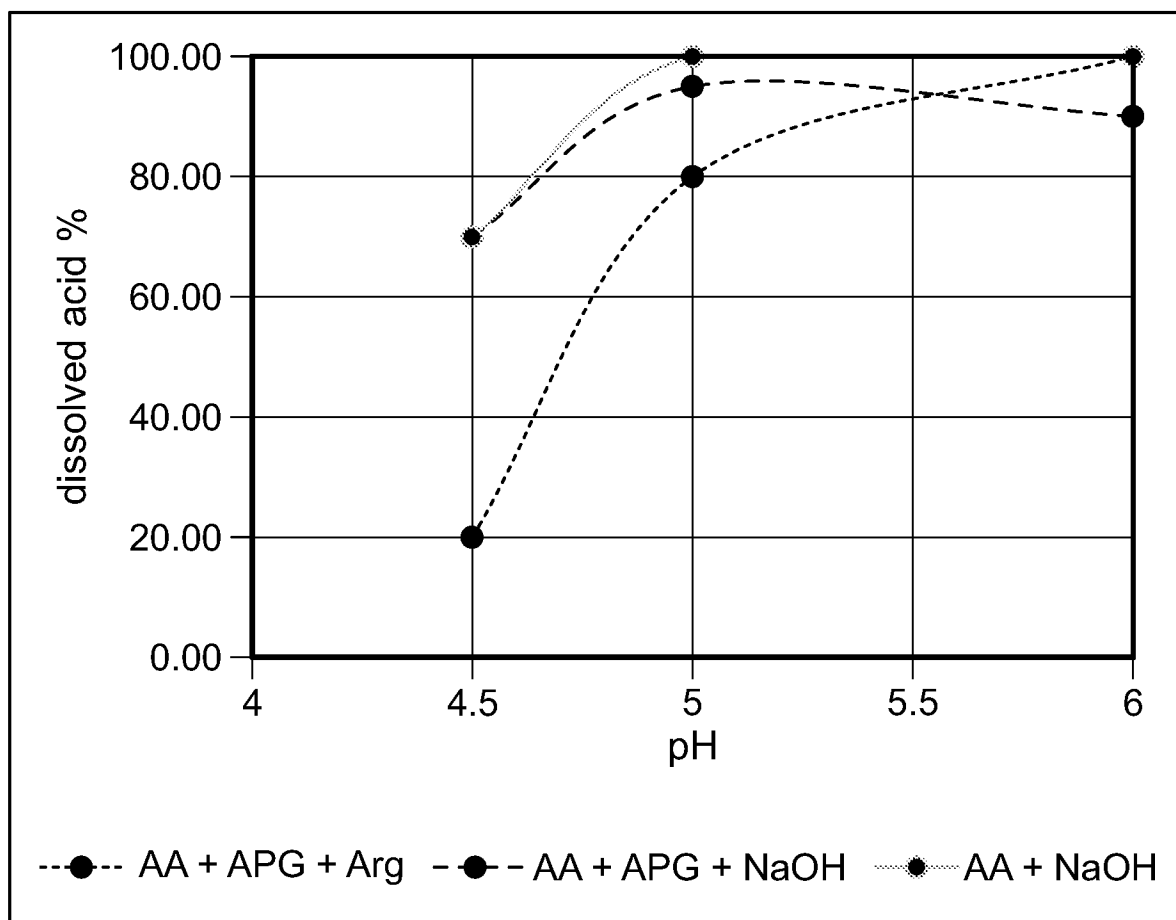


FIG. 1

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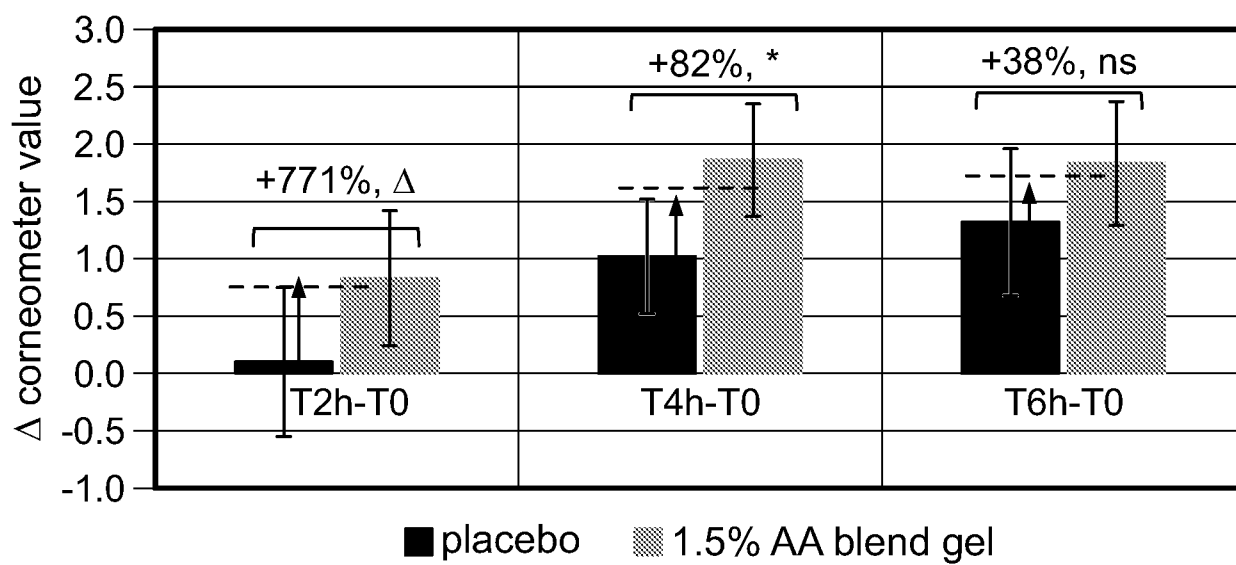


FIG. 2

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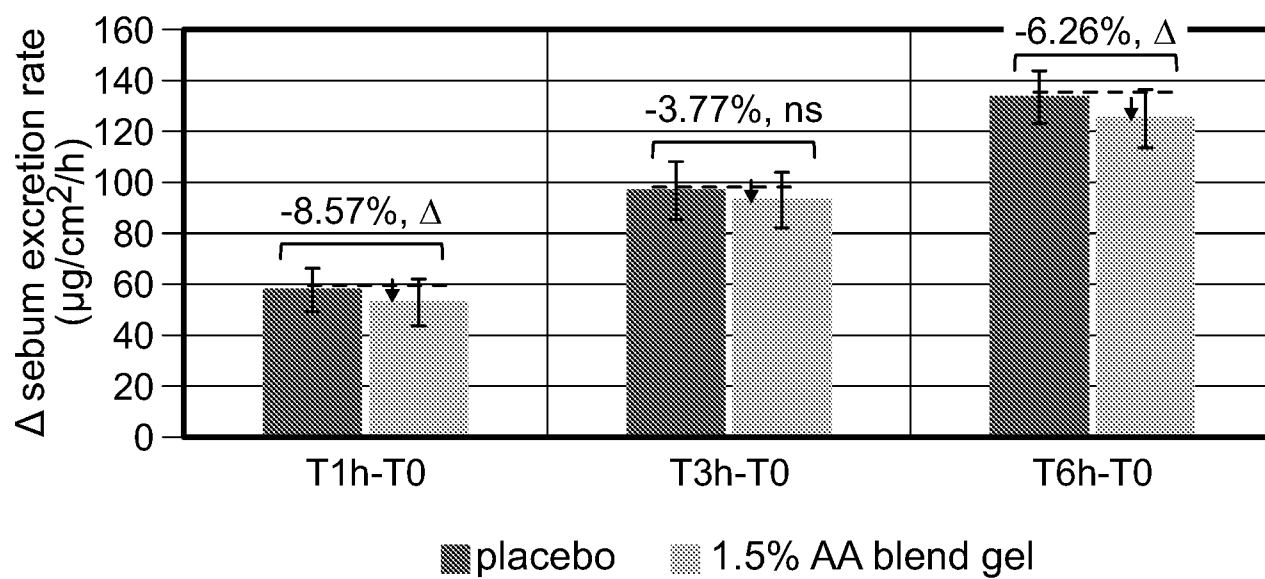


FIG. 3

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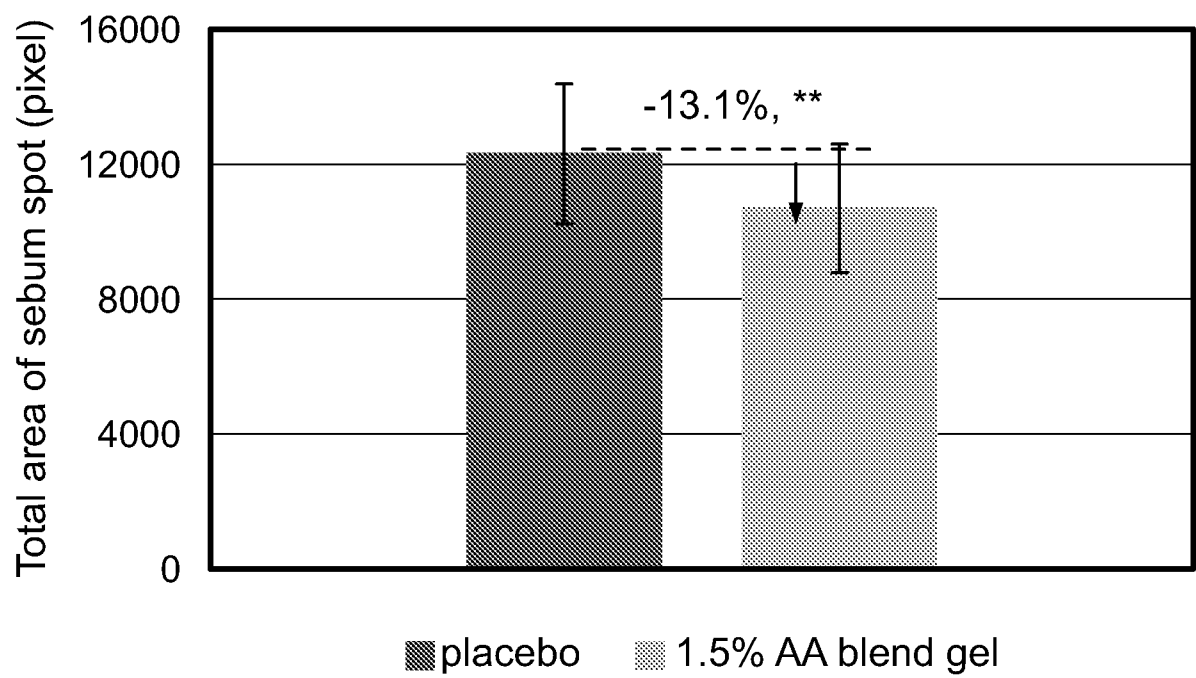


FIG. 4

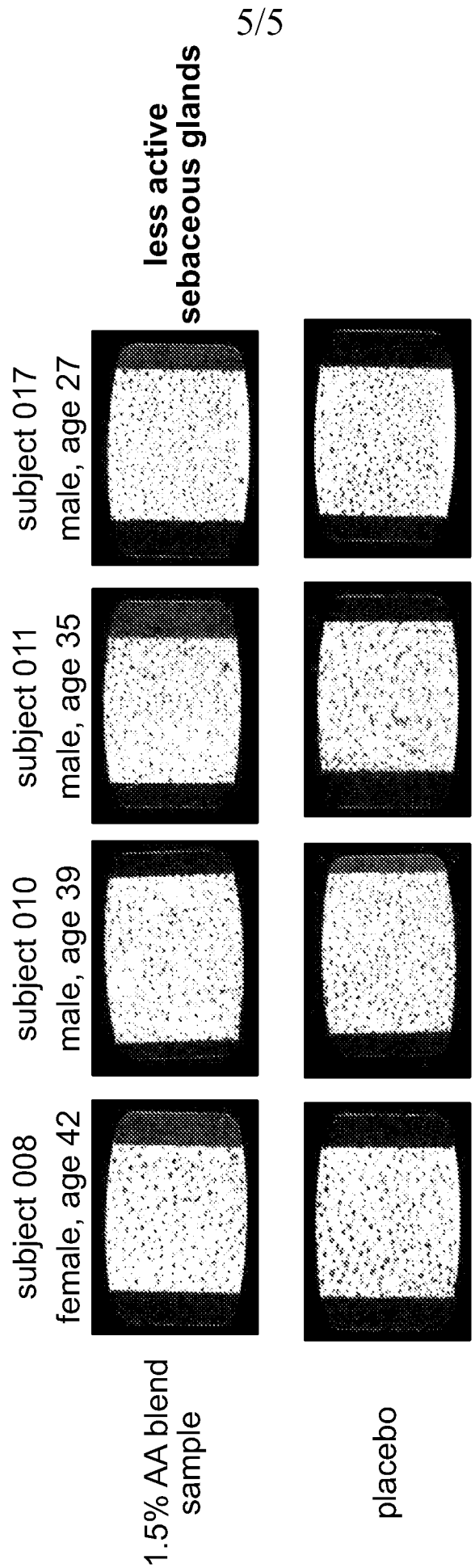


FIG. 5