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(54) Title: BIOCIDAL COMPOSITION

(57) Abstract: The biocidal composition, particularly but not exclusively a biocidal cleaning composition, comprises a water-based solution of an effective amount of one or more aliphatic alcohol, one or more detergent and one or more di-(long chain) quaternary ammonium salt. The composition is particularly characterised by an effective sporicidal activity in combination with an antibacterial and antiviral activity, via a relatively mild application method such as spray-on or wipe-on, on a range of surfaces including human skin and hard surfaces.

# BIOCIDAL COMPOSITION

## Field of the Invention

The present invention relates to a biocidal composition, particularly but not exclusively a biocidal cleaning composition.

## Background of the Invention

Modern biocidal cleaning compositions are required to have a range of applications in terms of the target organisms, the target surfaces and the method of contacting the composition with the surface for an effective action. The target organisms may be selected, for example, from bacteria, viruses, slimes, algae, moulds, mildews, fungi, yeasts, spores and more than one of these, preferably more than one strain or species of the particular organism type or types. The target surfaces may be selected from hard surface, soft surface, absorbent surface, skin and more than one of these. Within a particular target surface type, the method of contacting the composition and the surface may be selected, for example, from spray-on, wipe-on and rub-on.

The present invention is based on the surprising finding that a particular combination of ingredients has a surprisingly effective biocidal cleaning activity, leading to a broad range of applications.

## Brief Description of the Invention

According to a first aspect of the present invention, there is provided a biocidal composition, particularly but not exclusively a biocidal cleaning composition, comprising a water-based solution of an effective amount of one or more aliphatic

alcohol, one or more detergent and one or more di-(long chain) quaternary ammonium salt.

The composition is preferably transparent and colourless.

The composition may incorporate optional components, which may not affect the transparency and colourlessness of the composition or may cause the composition to be non-transparent or coloured. Such optional components may, for example, be selected from one or more buffer, one or more additional biocide, one or more complexing agent, one or more wetting agent, one or more antioxidant, one or more fragrance, one or more scent, one or more colorant, one or more bleach, one or more preservative and any combination thereof.

The composition may suitably consist essentially of, or consist of, the water-based solution of an effective amount of the one or more aliphatic alcohol, the one or more detergent and the one or more di-(long chain) quaternary ammonium salt, optionally together with ingredients selected from: one or more buffer, one or more additional biocide, one or more complexing agent, one or more wetting agent, one or more antioxidant, one or more fragrance, one or more scent, one or more colorant, one or more bleach, one or more preservative and any combination thereof.

The composition according to the present invention has been found to have a broad and high biocidal cleaning action on a range of surfaces, including skin.

According to a second aspect of the present invention, there is provided a method of killing target organisms selected from more than one of bacteria, bacterial endospores, bacterial exospores, viruses, slimes, algae, moulds, mildews, fungi, yeasts and spores thereof on a range of target surfaces selected from hard, soft, absorbent and skin surfaces, the method comprising spraying, wiping or rubbing the composition

according to the first aspect of the invention onto one of said surfaces to kill said organisms on the surface. The term "spores" and related expressions used herein refers to all forms of spore, including, for example, mould and fungal spores, bacterial endospores and bacterial exospores.

The said activity is surprisingly enhanced in comparison with commercially available compositions. In one such prior art composition one or more long-chain alkyl polyamine compounds, especially an alkyl triamine compound, is used in place of the one or more di-(long chain) quaternary ammonium salt according to the present invention (see WO-A-2004/101725).

The composition is particularly characterised by an effective sporicidal activity in combination with an antibacterial and antiviral activity, via a relatively mild application method such as spray-on or wipe-on, on a range of surfaces including human skin and hard surfaces. This activity or aspects of it (for example the sporicidal action or the antibacterial action or the antiviral action or any combination thereof) is surprisingly enhanced in comparison with the prior art compositions.

The composition is safe for human contact.

The mechanism of action of the composition of the present invention is not fully understood. Without being bound by theory, it is believed that the combination of components surprisingly ruptures the tough cell walls of fungal and mould spore cells. This effect is believed to derive from the biocidal composition comprising a water-based solution of an effective amount of one or more aliphatic alcohol, one or more detergent and one or more di-(long chain) quaternary ammonium salt.

A further aspect of the present invention therefore provides the use of one or more di-(long chain) quaternary ammonium salt as a sporicide, for example in a biocidal

composition, particularly but not exclusively a biocidal cleaning composition, for example a composition according to the first aspect of the present invention.

## Detailed Description of the Invention

*Aliphatic alcohol*

The one or more aliphatic alcohol may suitably be selected from aliphatic alcohols containing between 1 and 5 carbon atoms and mixtures thereof. The mixture may consist of two such alcohols. Examples of such alcohols include ethanol, n-propanol and mixtures thereof.

The aliphatic alcohol may suitably comprise between about 3 and about 30% w/w of the composition, for example between about 3 and about 10% w/w of the composition.

*Detergent*

The composition comprises one or more detergent (surfactant).

A suitable detergent (surfactant) may be one or more amphoteric or cationic surfactant. Preferably one or a mixture of amphoteric surfactants are used. Betaine amphoteric surfactants, for example sulphobetaines, are particularly suitable. The di-(long chain) quaternary ammonium salt is typically incompatible with anionic surfactants.

An example of a suitable detergent is Sandobet® SC or Genegen® SC or Sandoteric® SC, each a sulphobetaine amphoteric surfactant, or Sandoteric® ABD, a complex mixture of a amphoteric surfactants having a degree of biocidal activity, available from Clairant.

*Di-(long chain) quaternary ammonium salt*

The di-(long chain) quaternary ammonium salt may comprise or consist of one or more compound of formula:

$$(R^1)(R^2)N^+(R^3)(R^4) \quad A^-$$

where $R^1$ and $R^2$, which may be the same or different, are selected from alkyl groups having from 1 to 4 carbon atoms (preferably 1 or 2 carbon atoms) and alkenyl groups having from 2 to 4 carbon atoms (preferably 2 or 3 carbon atoms), $R^3$ and $R^4$, which may be the same or different, are selected from alkyl and alkenyl groups having from 7 to 21 carbon atoms (preferably 8 to 12 carbon atoms), and $A^-$ is a counteranion.

$R^1$ and $R^2$ are preferably the same. $R^1$ and $R^2$ are preferably selected from methyl, ethyl, ethenyl, n-propyl, n-propenyl, iso-propyl, iso-propenyl and n-butyl.

$R^3$ and $R^4$ are preferably the same. $R^3$ and $R^4$ are preferably selected from octyl, octenyl, nonyl, nonenyl, decyl, decenyl, undecyl, undecenyl and dodecyl dodecenyl, tridecyl, tridecenyl, tetradecyl and tetradecenyl.

The counteranion $A^-$ is suitably selected from halide (e.g. iodide, bromide, chloride or fluoride, preferably chloride), sulphate, nitrate, phosphate, sulphonate, hydroxide or carbonate anions. The counteranion is suitably selected so that the di-(long chain) quaternary ammonium salt is soluble in the water of the composition.

Preferably the di-(long chain) quaternary ammonium salt consists predominantly of one or more said compound. The expression "consist predominantly" means that more than half of the di-(long chain) quaternary ammonium salts of the composition are such compound(s).

A particularly preferred di-(long chain) quaternary ammonium salt is didecyldimethylammonium chloride, available under the trade name Bardac-22® or Bardac 2250® from Lonza Ltd, Basel, Switzerland.

*Buffer*

The composition may comprise one or more buffering agent.

A suitable buffering agent may be one or more of nitrilotriacetic acid and its salts, for example nitrilotriacetic acid trisodium salt (NTA).

*Additional biocide*

The composition may comprise one or more additional biocide, besides the essential components.

Proprietary microbicides such as Vi-Surf AFB®/Tegotaine AFB® may be used as additional biocides. Vi-Surf AFB®/Tegotaine AFB® is a blend of betaines and microbicides, more specifically a blend comprising amphoteric alkylaminocarboxylates and alkyl betaines, available from Evonik Industries.

Proprietary broad spectrum biocides such as, for example, biocidal tertiary amines, may also be used as additional biocides. An example of a suitable tertiary amine broad spectrum biocide is Lonzabac 12-100®, which is bis(3-aminopropyl) dodecylamine, available from Lonza Ltd, Basel, Switzerland. Lonzabac 12-100 has a broad spectrum antibacterial activity against both gram positive and gram negative bacteria, maintains high efficacy in the presence of heavy organic soiling, such as by

blood or protein, is antiviral against a range of viruses including enveloped viruses such as hepatitis B, has surfactant properties and is safe for human contact.

*Complexing agent*

The composition may comprise one or more complexing agent.

An example of a suitable complexing agent is Sandozin® NRW conc or Hoptapal® NRW, a polyethoxylate ether available from Clairant. Another complexing (chelating) agent that may conveniently be used is ethylenediamine tetraacetic acid (EDTA) or a salt thereof. This assists in solubilising and stabilising components of the composition. This complexing agent is commercially available as Dissolvine NA2® from Akzo Nobel (EDTA disodium salt dehydrate).

*Wetting agent*

The composition may comprise one or more wetting agent.

A suitable wetting agent may be one or more of polyglycol ether, such as a polyethylene glycol ether or a polypropylene glycol ether. An example of a suitable wetting agent is Sandozin® NRW conc, or Hoptapal® NRW, a polyethoxylate ether available from Clairant.

*Antioxidant*

The composition may comprise one or more antioxidant.

A suitable antioxidant may be one or more alkylated hydroxytoluene, such as butylated hydroxytoluene. An example of a suitable antioxidant is Topanol® O FG, a food grade butylated hydroxytoluene available from Chance & Hunt Ltd, UK.

*Concentration*

The composition may be used at any effective concentration.

A relatively concentrated form of the composition may comprise between about 10 and about 50 %w/w water. A relatively dilute form of the composition may comprise between about 50 and about 95 %w/w water.

The composition may suitably be bulk transported or sold as a concentrate and diluted for sale or use as desired.

For example, a concentrate form of the composition containing less than about 50% w/w water may retain its efficacy for different use situations up to a relative dilution of 1 part in 100 of water. A typical level of water dilution for surfaces on which a relatively mild biocidal action is required is between 1:1 and 1:20 composition:water by volume or weight.

*Uses*

The composition of the present invention may be formulated as a cleaning fluid for application to a surface and wiping off. The surface may be a floor, desk, bed, bath, basin, tap, handle, table, worktop, appliance or other hard surface, or an absorbent or soft surface. The composition may be formulated as a hand wash. In each case, suitable additional ingredients such as fragrances and colorants may be included in the formulation in conventional manner.

*Delivery*

The composition of the present invention may suitably be provided in a form ready for immediate delivery to a surface to be cleaned and disinfected.

The delivery device for such immediate delivery of the composition may be a controlled spray, such as a trigger spray or the like. A trigger spray advantageously allows a user to have a degree of remoteness from the surface the composition is to be used on, such that the composition may have already started to attack the pathogens present on said surface by the time the user comes into contact with the surface. Preferably, the composition for immediate delivery is capable of being stored in its delivery device for up to about 24 months and yet still being effective against pathogens and providing an acceptable cleaning effect on the surface which removes visible soiling.

The composition is preferably of a suitable viscosity to be sprayed through a spray nozzle of the controlled spray delivery device without blocking the nozzle, to deposit an even spray on the surface to be treated. The viscosity may, if necessary, be adjusted by dilution.

Alternatively, the composition may be suitable for vaporisation to create an aerosol or atmospheric mist, most preferably using a vaporisation (fogging) device, for fumigation of an airspace for destruction of pathogens both in the airspace and on surfaces in contact with the airspace.

Another delivery device for immediate delivery of the composition of the present invention may be an impregnated cloth or tissue wipe, for example a hand or skin wipe. Such wipes could be provided in a container or drum containing numerous

wipes, or provided in a single sachet form. Preferably such wipes are capable of being stored in their container for up to about 24 months and yet still being effective against pathogens and providing an acceptable cleaning effect on the surface which removes visible soiling.

*Manufacture*

The composition of the present invention may suitably be prepared by adding the one or more aliphatic alcohol, the one or more detergent, the one or more di-(long chain) quaternary ammonium salt and any desired optional components to water to prepare the water-based composition.

In the method of manufacture, the ingredients of the composition can be mixed in any order or sequence. A portion of a component may be added to a portion of another component, before that particular portion mixture is then mixed with other components or component mixtures or portion mixtures, to build the composition.

*Antibacterial Action*

The compositions of the present invention have effective pathogen killing action against a range of common bacteria, such as those infectious pathogenic bacteria commonly found on human hands, in homes, schools, restaurants, canteens, kitchens, hospitals and in other public places. Example of such bacteria are *escherichia coli*, *pseudomonas aeruginosa*, *staphylococcus aureus* including methacillin-resistant *staphylococcus aureus* (MRSA), *clostridium difficile*, *enterococcus hirae*, *mycobacterium spp*.

*Antiviral Action*

The compositions of the present invention have effective pathogen killing action against a range of common viruses (enveloped and non-enveloped), such as those infectious pathogenic viruses commonly transmitted to and between humans via air, water, solid surfaces and by contact in homes, schools, restaurants, canteens, kitchens, hospitals and in other public places. Examples of such viruses include hepatitis B, hepatitis C, influenza, avian influenza, swine influenza, human-mutated swine influenza, norovirus and human immunodeficiency virus (HIV).

*Antifungal/Algaecidal Action*

The compositions of the present invention have effective pathogen killing action against a range of common moulds, algae and fungi, such as those pathogenic moulds and fungi commonly transmitted to and between humans via air, water, solid surfaces and by contact in homes, schools, restaurants, canteens, kitchens, hospitals and in other public places. Examples of such fungi include *candida albicans, penicillium verrucosum, cladosporium cladosporoides, trichophyton mentagrophytes, absidia chorymbifera* and *aspergillus niger.* Examples of such algae include *chlorella vulgaris.*

*Sporicidal Action*

The compositions of the present invention have effective pathogen killing action against a range of common bacterial endospores and exospores, mould and fungal spores, such as those pathogenic spores commonly found on human hands, in homes, schools, restaurants, canteens, kitchens, hospitals and in other public places, for example the spores of the moulds and fungi identified above.

## Example

The following non-limiting example is provided for further illustration of the present invention.

*Example – Compositions and Tests*

A biocidal composition was prepared for testing purposes by admixture of the ingredients according to the following Table. All amounts are stated as % w/w.

The composition was found to have an effective biocidal activity, with significantly enhanced activity, compared with an analogous composition in which the di-(long chain) quaternary ammonium salt Bardac 2250 is replaced by a long-chain alkyl triamine (Triameen Y12D-30), against spores and optionally against other target organisms selected from more than one of bacteria, viruses, slimes, algae, moulds, mildews, fungi and yeasts on a range of target surfaces selected from hard, soft, absorbent and skin surfaces. The test methods included spraying, wiping or rubbing the compositions onto the test surfaces. The compositions of the present invention have a particularly effective sporicidal activity in combination with an antibacterial and antiviral activity, via a relatively mild application method such as spray-on or wipe-on, on a range of surfaces including human skin and hard surfaces.

## Table

| Ingredient | Amount (%w/w) |
|---|---|
| | |
| Dissolvine NA2 powder | 0.85 |
| n-Propanol | 5 |
| Topanol O | 0.15 |
| Sandobet | 2.42 |

| | |
|---|---|
| SC/Genegen SC | |
| Sandozin NRW/Hoptapal NRW | 6.95 |
| Vi-Surf AFB/Tegotain AFB | 4.45 |
| Bardac 2250 | 19.99 |
| Demineralised water | 60.19 |
| | |
| **Total** | 100 |

The foregoing broadly describes the present invention without limitation. Variations and modifications as will be readily apparent to those skilled in this art are intended to be included in the scope of the present invention as defined in and by the appended claims.

## CLAIMS

1. A biocidal composition comprising a water-based solution of an effective amount of one or more aliphatic alcohol, one or more detergent and one or more di-(long chain) quaternary ammonium salt.

2. A composition according to claim 1, which is transparent and colourless.

3. A composition according to claim 1 or claim 2, further comprising components selected from one or more buffer, one or more additional biocide, one or more complexing agent, one or more wetting agent, one or more antioxidant, one or more fragrance, one or more scent, one or more colorant, one or more bleach, one or more preservative and any combination thereof.

4. A composition according to any one of the preceding claims, having sporicidal activity in combination with an antibacterial and antiviral activity, via a relatively mild application method such as spray-on or wipe-on, on a range of surfaces including human skin and hard surfaces.

5. A method of killing target organisms selected from more than one of bacteria, viruses, slimes, algae, moulds, mildews, fungi, yeasts and spores on a range of target surfaces selected from hard, soft, absorbent and skin surfaces, the method comprising spraying, wiping or rubbing the composition according to any one of the preceding claims onto one of said surfaces to kill said organisms on the surface.

6. Use of one or more di-(long chain) quaternary ammonium salt as a sporicide.

7. Use according to claim 6, wherein the one or more di-(long chain) quaternary ammonium salt is a component of a biocidal composition, particularly but not exclusively a biocidal cleaning composition.

8. Use according to claim 7, wherein the biocidal composition is a composition according to any one of claims 1 to 4.

9. A composition, a method of killing organisms, or a use as a sporicide, substantially as herein described.