

A HAND SANITISER COMPOSITION

Abstract

A rinseless sanitiser composition suitable for use on human skin is provided. The sanitiser composition provides antiviral and anti-bacterial properties. The said sanitiser comprises at least one effective amount of encapsulated quaternary ammonium compound, an effective amount of ethanol alcohol, a water dispersible hydrophobic waterproofing film forming agent, a nanoclay, a humectant and water. When applied to the skin, the composition kills 99.99% most common household germs and virus within a short of time and provides persistent protection against potentially harmful, disease-causing pathogens.

Field of the Invention

The present invention relates to a sanitiser composition, and in particular to a rinseless sanitiser composition suitable for use on human skin.

Discussion of the Related Art

Microorganisms are well known to present health hazards, for example bacteria and virus such as E .Coli, pathogens which can cause many common infection. SARS and more recently MRSA, H1N1 and COVID-19 have been responsible for many deaths.

Antimicrobial compositions are well known in the art, and are widely commercially available. For example, bacteriocidal, fungicidal, algicidal, yeasticidal and moldicidal agents are known. 75% alcohol is one of most common used antimicrobial agents to destroy microorganisms in a wide range of environments, including medical, industrial and domestic.

Personal hygiene and in particular the sanitisation of hands is widely accepted as a particularly effective means to hinder or prevent the transmittal of microorganisms by touch.

Effective hand-washing is time-consuming. To speed up this process, these generally involve the use of ethyl alcohol as an antimicrobial agent.

However, there are several disadvantages with ethyl alcohol-based skin sanitisers. Alcohol based sanitisers typically contain 60 to 90 weight percent alcohol, which high percentage of ethyl alcohol can remove the protective sebum layer on the skin and dries the skin, and so

repeated use can lead to skin damage. Whilst its evaporation at body temperature leads to quick drying, it also means it can have evaporated before the user has been able to rub it into all parts of their hand.

On the other hand, typically, non-alcoholic based sanitisers have been unable to replace rival alcoholic sanitisers because they are not as effective against a wide range of microorganisms.

Therefore there exists a need for an improved sanitiser which overcomes at least some of the disadvantages of the prior art and which has at least some of the following characteristics:

- 1) Fast effect on anti-microbial activity
- 2) Long lasting antibacterial protection and invisible shield Prevents skin infection
- 3) NO or Less irritating to the skin
- 4) Wild range of excellent anti-viral and anti-bacterial properties

Whilst the inventors had developed a sanitiser composition suitable for use on human skin comprising:

- 1) at least one encapsulated quaternary ammonium compound
- 2) an ethyl alcohol
- 3) a water dispersible hydrophobic waterproofing film forming agent
- 4) a humectant
- 5) a nanoclay
- 6) and water

OBJECTS AND ADVANTAGES OF THE INVENTION

It is a primary object of the present invention to provide a safe and effective hand wash for providing long lasting and persistent antiviral, antibacterial, and antifungal protection with no or less skin irritating.

The advantages of present inventions are

- a) ethyl alcohol provides fast effect to kill bacteria and virus
- b) combine ethyl alcohol and quaternary ammonium compound to provide wild range of excellent anti-viral and anti-bacterial properties
- c) quaternary ammonium compounds are encapsulated. The mechanism of bactericidal/microbicidal action from quaternary ammonium compound is thought to be due to disruption of intermolecular interactions. This disruptive action is relatively

rapid in nature. However, when used in a delivery system by encapsulation, the effect is prolonged and provides an increased duration of activity.

- d) water dispersible hydrophobic waterproofing film forming agent to form a mesh over the skin and further prevent the quaternary ammonium compound to be washed away, thus provide a long-lasting effect of anti- Microorganisms properties
- e) nanoclay as a control release carrier for antimicrobial, antiviral acts ingredient to further enhance long-lasting effect of anti- Microorganisms properties
- f) at the same time, water dispersible hydrophobic waterproofing film forming agent, inorganic nanoclay and humectant work together to help lock in water to prevent the fast evaporation of water from the skin to reduce the irritating of alcohol to the skin

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

According to the present inventions, a hand sanitiser composition suitable for use on human skin comprising:

- a) at least one encapsulated quaternary ammonium compound
- b) an ethyl alcohol
- c) a water dispersible hydrophobic waterproofing film forming agent
- d) a humectant
- e) and water

The hand sanitiser composition further comprising an inorganic nanoclay, which essentially consists of layered silicates stacked together with the excess negative charge is balanced by cations, such as Na⁺, Li⁺, Ca²⁺, etc.

The quaternary ammonium compound was encapsulated according to US patent 7115282 B2. A commercially available encapsulated quaternary ammonium compound, for example, HydroSal™ BKC (Benzalkonium Chloride), was provided by Salvona's patented technologies, which focus on nano, sub-micron, micro, and macro encapsulation and delivery systems for skincare and cosmetic active ingredients. Encapsulation has the power to stabilize actives, reducing product side effects and greatly extending shelf life of OTC (over-the-counter) and prescription skincare and cosmetic products.

The hand sanitiser composition further comprising at least one Emollient oil.

The quaternary ammonium compound has the formula NR⁺X wherein each group R is independently selected from a substituted or unsubstituted alkyl, aryl, alkaryl, aralkyl, Benzalk,

ether, or polyoxyalkyl group, or two R groups may combine to form a heterocyclic compound, and X is an anion.

The X is selected from chloride ion and bromine ion.

The quaternary ammonium compound is a tetraalkyl ammonium salt with the alkyl group from 10 to 16 carbon atoms.

The quaternary ammonium compound has biocidally effective amount and is selected from Benzalkonium Chloride, Alkyl dimethyl benzyl ammonium chlorides, Alkyl dimethyl ethyl benzyl ammonium chlorides.

The water dispersible hydrophobic waterproofing film forming agent is a Vinylpyrrolidone /Acrylates/Lauryl Methacrylate Copolymer, which is capable of forming a mesh over the skin.

The water dispersible hydrophobic waterproofing film forming agent is based on sustainably-sourced, zero-deforestation, wood-derived cellulose.

The commercial product, antaron™ (ganex™) sensory polymer and Antaron™ ECo ethylcellulose was provided by Ashland.

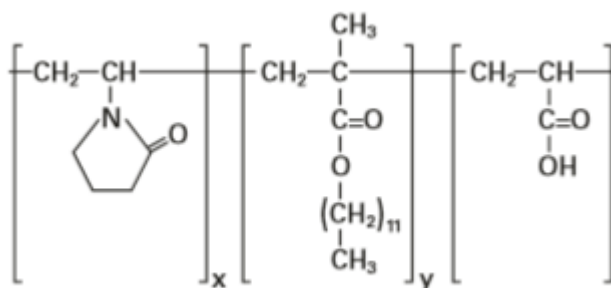


Figure 1. Structure of Vinylpyrrolidone /Acrylates/Lauryl Methacrylate Copolymer

In this invention, alcohol, ethanol and ethyl alcohol all has same meaning as ethyl alcohol ($\text{C}_2\text{H}_5\text{OH}$), and can be used exchangeable. The ethyl alcohol in the hand sanitiser composition is present in a range of 60%-80%, preferably about 75%.

The humectant in the hand sanitiser composition is Glycerin.

The present inventions further comprise a nanoclay base on montmorillonite (MMT), having a cationic exchange capacity at the range of 80-120 mmol/100 g MMT.

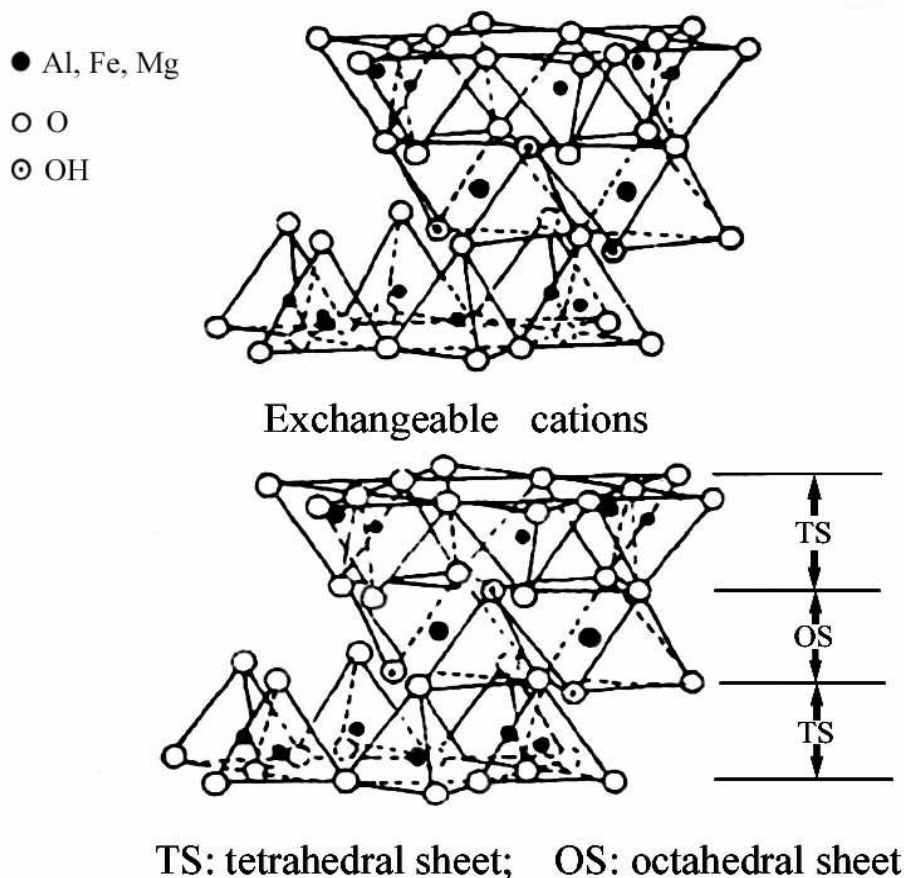


Figure 2. Structure of MMT

In the study “Controlled Release of Agrochemicals Intercalated into Montmorillonite Interlayer Space”, The Scientific World Journal, Volume 2014 |Article ID 656287 | 9 pages | <https://doi.org/10.1155/2014/656287>, the authors disclosed the ability of montmorillonite (MMT) clay to act as a controlled release carrier for model agrochemical molecules, such as pesticide. The study shows, for a period of 30 days, MMT delayed the release of metalaxyl in soil by more than 6 times. It is evident that MMT could be used to improve the efficiency of pesticide delivery in the soil.

R.H.Dowdy & M.M. Mortland, in there article “Alcohol-water interactions on Montmorillonite surface. I. Ethanol” (Clays and Clay Minierals, volume 15, page 259-271,1967) reported the adsorption effect of water and alcohol with MMT.

The advantages of present inventions by using nanoclay are:

- a) nanoclay provides a tortuous path effect to further reduce speed of the antimicrobial, antiviral acts ingredient, such as quaternary ammonium compounds to be washed away and provide a long-lasting effect of anti-Microorganisms properties
- b) nanoclay provides an anchoring point for the quaternary ammonium to be anchored by ionic interaction at the clay surface which enhances the long-lasting effect of anti-Microorganisms properties

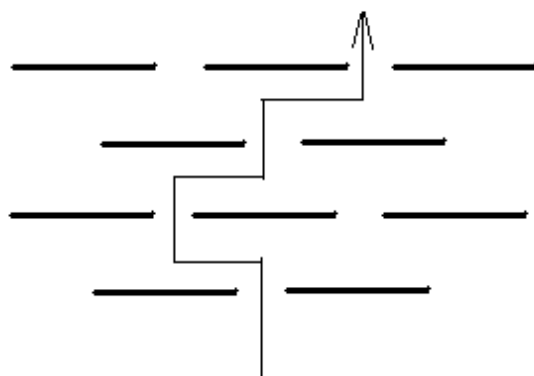


Figure 3. Illustration of tortuous path model for barrier enhancement

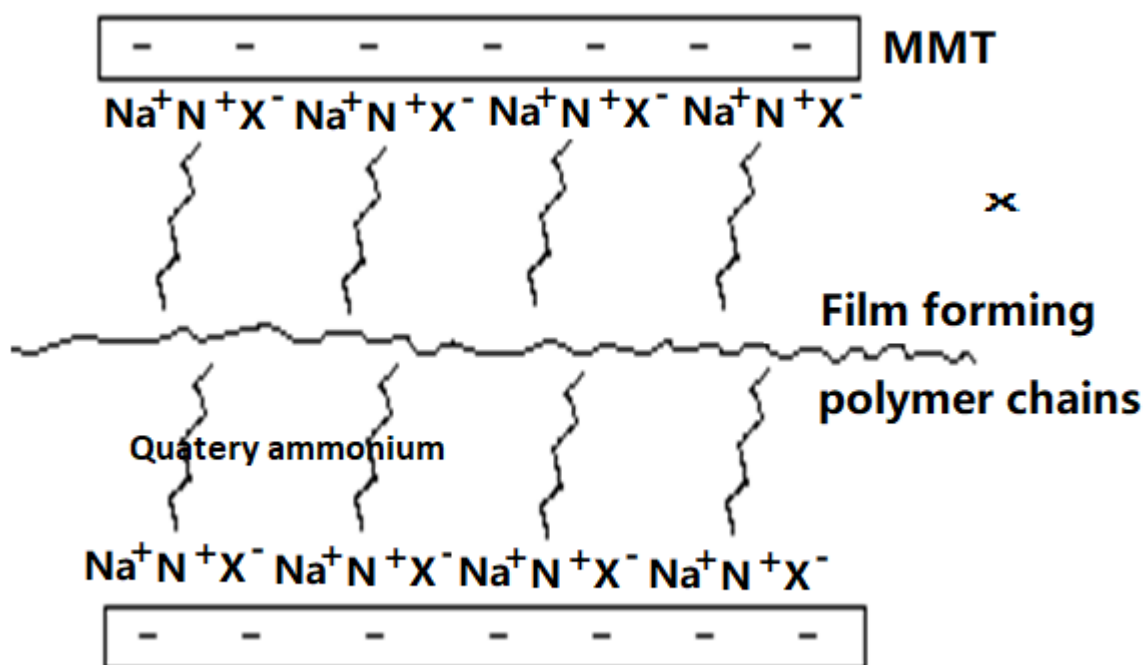


Figure 4. Illustration of model ionic interaction of MMT with quaternary ammonium

The present inventions, the composition of the hand sanitiser comprising:

- a) at least one biocidally effective amount of encapsulated quaternary ammonium compound
- b) a biocidally effective amount of ethyl alcohol
- c) a water dispersible hydrophobic waterproofing film-forming agent
- d) a humectant
- e) a nanoclay
- f) and water

The present inventions, the composition of the hand sanitiser comprising:

- a) at least one encapsulated quaternary ammonium compound 0.05% to 0.2%
- b) an ethyl alcohol 65% to 80%
- c) a water dispersible hydrophobic waterproofing film forming agent 0.1% to 2.0%
- d) a humectant 0.5% to 1.6%
- e) an Emollient oil 0.1% to 0.6%
- f) a nanoclay 0.1% to 1%
- g) and water

The present inventions, the nanoclay in the hand sanitiser composition is Na⁺ montmorillonite (MMT).

A non-pressurised pump comprising the sanitiser composition is provided for dispensing the composition as a foam.

The water dispersible hydrophobic waterproofing film forming agent is a copolymer of Vinylpyrrolidone /Acrylates/Lauryl Methacrylate Copolymer, which is capable of forming a mesh over the skin.

According to present inventions, the products useful in controlling infectious agents, such as bacteria and viruses, are disclosed which are suitable for preparing personal care products and sanitary cleaning products for example. In particular compositions are provided which shows no or less primary skin irritation and provides long lasting anti-viral and anti-bacterial properties.

They are preferably packaged in tubes or jars and are applied easily with the fingers onto the skin and/or the face. Guided by the teachings in this specification, a person skilled in the art can routinely choose possible additional compounds and/or the amounts thereof so that the advantageous properties intrinsically associated with the combination in accordance with the invention are not damaged, or are substantially not damaged, by the addition(s) envisaged.

The examples which follow serve to illustrate the invention without, however, being limiting in nature.

Compositions of the Invention

Examples of sanitiser composition includes but are not limited to: Demineralised water, Na⁺ montmorillonite, HydroSal™ BKC (Encapsulated Benzalkonium Chloride), Encapsulated Alkyl dimethyl benzyl ammonium chlorides, Encapsulated Alkyl dimethyl ethyl benzyl ammonium chlorides, Antaron™ (ganex™, water dispersible hydrophobic waterproofing film forming agent) sensory polymer from Ashland, Ceraphyl™ 230 ester (Emollient oil) from Ashland, Glycerine, Alcohol, Demineralised water.

EXAMPLE 1.

An embodiment of the sanitiser composition of the present invention has the following composition:

Name of the Ingredient	Wt%
Demineralised water	21.75
Na ⁺ montmorillonite	0.15
HydroSal™ BKC	0.1
Antaron™ (ganex™) sensory polymer	0.7
Emollient oil Ceraphyl™ 230 ester	0.5
Glycerine	1.8
Ethyl alcohol	75
Total	100

The composition was prepared as follows: The process was performed at room temperature. Demineralized water was added to the tank and under strongly agitated by adding Na⁺ montmorillonite, HydroSal™ BKC, Antaron™ (ganex™) sensory polymer, Ceraphyl™ 230, Glycerine and Alcohol sequentially.

EXAMPLE 2.

An embodiment of the sanitiser composition of the present invention has the following composition:

Name of the Ingredient	Wt%
Demineralised water	26.3
Na ⁺ montmorillonite	0.8
HydroSal™ BKC	0.2
Antaron™ (ganex™) sensory polymer from Ashland	1.5
Emollient oil Ceraphyl™ 230 ester from Ashland	0.2
Glycerine	1
Ethyl alcohol	70
Total	100

The composition of the above example is prepared in the manner described above with reference to Example 1.

EXAMPLE 3.

An embodiment of the sanitiser composition of the present invention has the following composition:

Name of the Ingredient	Wt%
Demineralised water	22.03
Na ⁺ montmorillonite	0.1
HydroSal™ BKC	0.17
Antaron™ (ganex™) sensory polymer from Ashland	0.5
Emollient oil Ceraphyl™ 230 ester from Ashland	0.6
Glycerine	1.6
Ethyl alcohol	75
Total	100

The composition of the above example is prepared in the manner described above with reference to Example 1.

EXAMPLE 4.

An embodiment of the sanitiser composition of the present invention has the following composition:

Name of the Ingredient	Wt%
Demineralised water	17.62
Na ⁺ montmorillonite	0.5
HydroSal™ BKC	0.08
Antaron™ (Ganex™) sensory polymer from Ashland	0.7
Emollient oil Ceraphyl™ 230 ester from Ashland	0.3
Glycerine	0.8
Ethyl alcohol	80
Total	100

The composition of the above example is prepared in the manner described above with reference to Example 1.

EXAMPLE 5.

An embodiment of the sanitiser composition of the present invention has the following composition:

Name of the Ingredient	Wt%
Demineralised water	22.17
Na ⁺ montmorillonite	0.2
HydroSal™ BKC	0.13
Antaron™ (ganex™) sensory polymer from Ashland	0.5
Emollient oil Ceraphyl™ 230 ester from Ashland	0.5
Glycerine	1.5

Alcohol	75
Total	100

The composition of the above example is prepared in the manner described above with reference to Example 1.

In each of the above examples, the percentage range of each ingredient is based on the amount of each ingredient by weight of the entire composition.

Testing Results

Market commercial sanitizer products are selected to compare.

Comparing the following samples:

Product Code	Description	Source
Market Product A	70% Alcohol, unknown amount of humectants	Medical use ethanol
Market Product B	70% Alcohol, 0.5% Chlorhexidine Gluconate, unknown amount of humectants.	Pharmacy Shop
Market Product C	Water, 0.1% BKC, unknown amount of surfactants.	Temasek Foundation
Market Product D	Water, 0.1% silanated BKC, unknown amount of surfactants.	Pharmacy Shop

Test 1. Validate chemical disinfectants and antiseptics can kill 99.99% germs

Test Method "BS EN 1040:2005" (Contact time: 5 mins and 24 hours)

Microbial used in the tests:

- 1) Staphylococcus aureus ATCC 6538
- 2) Pseudomonas aeruginosa ATCC 10145
- 3) Escherichia coli ATCC 8739
- 4) Bacillus cereus ATCC 11778
- 5) Candida Albicans ATCC 10231

Contact time	Final Concentration CFU per ml (Plate Count)	Log ₁₀ Reduction Achieved	Percentage Kill of Test Microorganism
5 mins	0,0	>7	99.999
24 hours	0,0	>7	99.999

Examples 1-5 are selected to test and the results are shown in the table. The testing result shows the invented sanitiser can kill 99.999% all kinds of test microorganism both in a 5 mins and 24 hours.

Test 2. Compare long lasting disinfectants and antiseptics effect of present invented sanitiser composition to different kinds of commercially available hand sanitizers after applied on a surface in a duration of 24 hours.

Test Method:

1. On a glass surface (petri dish), [4 ml] hand sanitizer was applied, air-dried in-door for 6 hours at room temperature.
2. Continued to expose in-door for subsequent 18 hours at room temperature (for a total duration of 24 hours).
3. A specific amount of microbial solution was applied to the glass surface, covered with lid, and allowed to stand for a few hours at room temperature.
4. The glass surface was swabbed and tested in accordance to test method "ISO 4833-1:2013".

Sample	Remarks	Final Concentration CFU per ml (Plate Count)
Example 1	Excellent. Antiseptic effect lasts up to 24 hours after hand sanitizer is applied on the surface and dried. No germs can live on the surface.	<1
Market Product A	Negative. Antiseptic effect disappears after hand sanitizer is applied on the surface and dried. Significant amount of germs can live on the surface.	>57,000,000
Market product B	Negative. Antiseptic effect disappears after hand sanitizer is applied on the surface and dried. Large amount of germs can live on the surface.	76000
Market product C	Negative. Antiseptic effect disappears after hand sanitizer is applied on the surface and dried. Moderate amount of germs can live on the surface.	22000
Market product D	Antiseptic effect lasts up to 24 hours after hand sanitizer is applied on the surface and dried. However, small amount of germs still can live on the surface.	82

After hand sanitizers applied on the surface and dried in a duration of 24 hours, the testing result shows: Market Product A (based on alcohol) completely loses antiseptic effect and significant amount of germs lives on the surface; Market Product B (based on combination of alcohol and Chlorhexidine Gluconate) loses antiseptic effect and large amount of germs lives on the surface; Market Product C (based on BKC) loses antiseptic effect and moderate amount of germs lives on the surface; Market Product D (based on silanated BKC) more or less keeps antiseptic effect, however small amount of germs still lives on the surface; the

present invented sanitizer excellently keeps antiseptic effect up to 24 hours and no germs can live on the surface.

Test 3. Compare long lasting disinfectants and antiseptics effect of present invented sanitiser composition to different kinds of commercially available hand sanitizers after repeated washing and drying in a duration of 24 hours.

Test Method:

1. On a glass surface (petri dish), [4 ml] hand sanitizer was applied, air-dried in-door for 6 hours at room temperature.
2. The surface was soaked and rinsed with a specific amount [20 ml] of water. Allowed to air-dried, for subsequent 6 hours at room temperature. This step was repeated for another two times (for a total duration of 24 hours).
3. A specific amount of microbial solution was applied to the glass surface, covered with lid, and allowed to stand for a few hours at room temperature.
4. The glass surface was swabbed and tested in accordance to test method "ISO 4833-1:2013"

Sample	Remarks	Final Concentration CFU per ml (Plate Count)
Example 1	Excellent. Even after repeated wash and dry, antiseptic effect lasts up to 24 hours after hand sanitizer is applied on the surface. No germs can live on the surface.	<1
Market Product A	Negative. Antiseptic effect disappears after hand sanitizer is applied on the surface and dried and after repeated wash and dry. Significant amount of germs can live on the surface.	>57,000,000
Market product B	Negative. Antiseptic effect disappears completely, after hand sanitizer is applied on the surface, dried, and after repeated wash and dry. Large amount of germs can live on the surface.	64000
Market product C	Negative. Antiseptic effect disappears completely, after hand sanitizer is applied on the surface, dried, and after repeated wash and dry. Significant amount of germs can live on the surface.	>5700000
Market product D	Even after repeated wash and dry, moderate antiseptic effect lasts up to 24 hours after hand sanitizer is applied on the surface. Small amount of germs can live on the surface.	68

After hand sanitizers applied on the surface and repeated washing and drying in a duration of 24 hours, the testing result shows: Market Product A (based on alcohol) completely loses antiseptic effect and significant amount of germs lives on the surface; Market Product B (based on combination of alcohol and Chlorhexidine Gluconate) loses antiseptic effect and large amount of germs lives on the surface; Market Product C (based on BKC) loses antiseptic effect and significant amount of germs lives on the surface; Market Product D (based on silanated BKC) more or less keeps antiseptic effect, however small amount of germs still can live on the surface; the present invented sanitizer excellently keeps antiseptic effect up to 24 hours with repeated washing and drying and no germs can live on the surface.

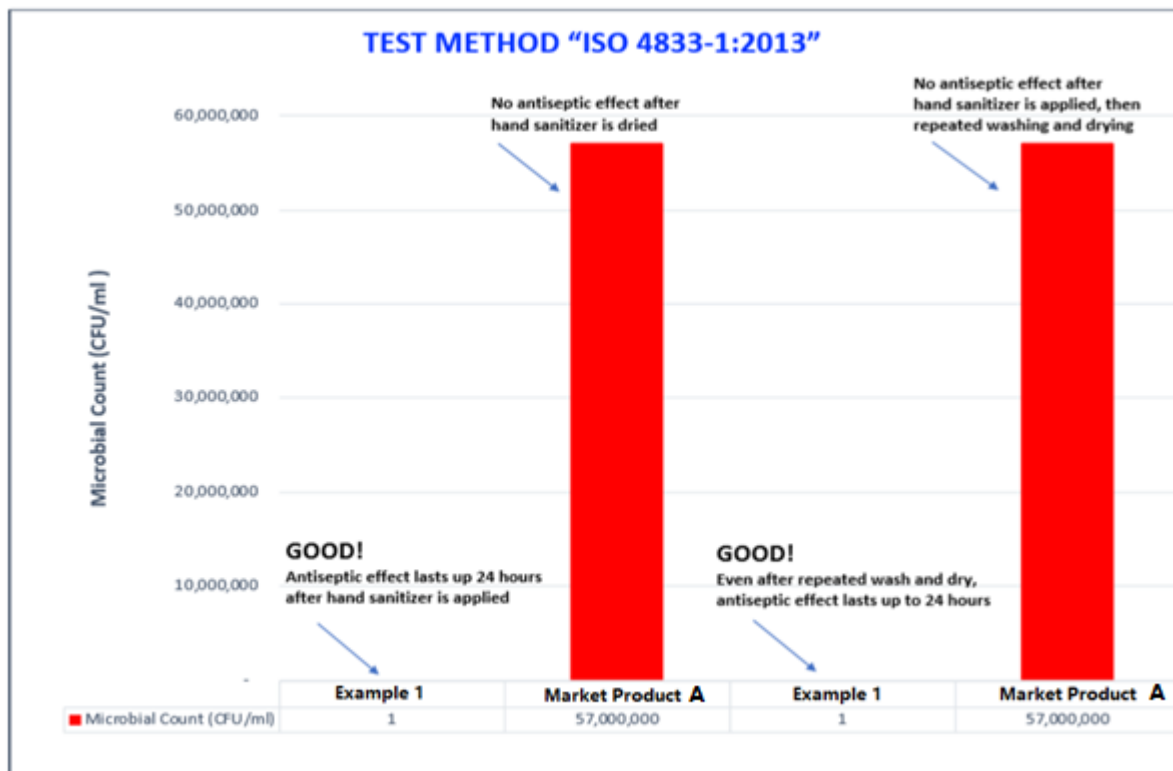


Figure 5. Compare long lasting anti-Microorganisms properties of present invented sanitiser composition to market alcohol-Based sanitiser product

Repeat test 2 and 3 with examples 2-5, they all show similar results as example 1. Replaced HydroSal™ BKC (Encapsulated Benzalkonium Chloride) by encapsulated alkyl dimethyl benzyl ammonium chlorides or encapsulated alkyl dimethyl ethyl benzyl ammonium chlorides, they all show similar results as example 1.

CLAIMS

1. A hand sanitiser composition suitable for use on human skin comprising:
 - a) at least one quaternary ammonium compound
 - b) an ethyl alcohol
 - c) a water dispersible hydrophobic waterproofing film forming agent
 - d) a humectant
 - e) and water
2. A composition according to claim 1 wherein said at least one quaternary ammonium compound is encapsulated.
3. A composition according to claim 1 further comprising a nanoclay.
4. A composition according to claim 1 further comprising an emollient oil.
5. A composition according to claim 1 and 2 wherein said at least one quaternary ammonium compound has the formula NR^+X^- wherein each group R is independently selected from a substituted or unsubstituted alkyl, aryl, alkaryl, aralkyl, Benzalk, ether, or polyoxyalkyl group, or two R groups may combine to form a heterocyclic compound, and X is an anion, selected from chloride ion and bromine ion.
6. A composition according to claim 3 wherein said nanoclay essentially consists of layered silicates stacked together with the excess negative charge is balanced by cations, such as Na^+ , Li^+ , Ca^{2+} , etc.
7. A composition according to any preceding claim wherein said at least one quaternary ammonium compound has biocidally effective amount and is selected from Benzalkonium Chloride, Alkyl dimethyl benzyl ammonium chlorides, Alkyl dimethyl ethyl benzyl ammonium chlorides.
8. A composition according to any preceding claims wherein the water dispersible hydrophobic waterproofing film forming agent is a Vinylpyrrolidone /Acrylates/Lauryl Methacrylate Copolymer, which is capable of forming a mesh over the skin.
9. A composition according to any preceding claim wherein said the ethyl alcohol is present in a range of 65%-80%, preferably about 75%.
10. A composition according to any preceding claim wherein said the humectant is Glycerin.
11. A composition according to claim 3 and 6 wherein said the nanoclay is based on montmorillonite (MMT) having a cationic exchange capacity at the range of 80-120 mmol/100 g MMT.
12. A composition according to any preceding claim wherein the hand sanitiser comprising:
 - 1) at least one biocidally effective amount of encapsulated quaternary ammonium compound

- 2) a biocidally effective amount of ethyl alcohol
- 3) a water dispersible hydrophobic waterproofing film-forming agent
- 4) a humectant
- 5) an emollient oil
- 6) a nanoclay
- 7) and water

13. A composition according to any preceding claim wherein the hand sanitiser comprising:

- 1) at least one encapsulated quaternary ammonium compound 0.05% to 0.2%
- 2) an ethyl alcohol 65% to 80%
- 3) a water dispersible hydrophobic waterproofing film forming agent 0.1% to 2.0%
- 4) a humectant 0.5% to 1.6%
- 5) an Emollient oil 0.1% to 0.6%
- 6) a nanoclay 0.1% to 1%
- 7) and water

14. A composition according to any preceding claim wherein said the nanoclay is Na⁺ montmorillonite (MMT).

15. A composition according to any preceding claim wherein said at least one quaternary ammonium compound is encapsulated Benzalkonium Chloride.

16. A composition according to any preceding claim wherein the water dispersible hydrophobic waterproofing film forming agent is a Vinylpyrrolidone /Acrylates/Lauryl Methacrylate Copolymer, which is capable of forming a mesh over the skin.

17. A composition according to any preceding claim wherein said the humectant is Glycerine.

18. A composition according to any preceding claim wherein said emollient oil is dry, non-greasy esters.

19. A non-pressurised pump comprising the sanitiser composition is provided for dispensing the composition as a foam.