

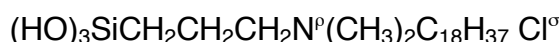
ZONO TECHNICAL OVERVIEW

CHEMICAL STRUCTURE & NOMENCLATURE

Compound (ODTA)

Octadecyldimethyl(3-trihydroxysilylpropyl)ammonium chloride

Structure



Note: This material is classified as an organ functional trihydroxysilane as it contains a functional organic group (quaternary nitrogen) covalently bound to a silicon atom. Organosilane denotes a minimum of one carbon-silicon bond. Trihydroxy describes the number of hydroxy groups bound to the silicon atom.

General Silane Chemistry

ODTA Prep.



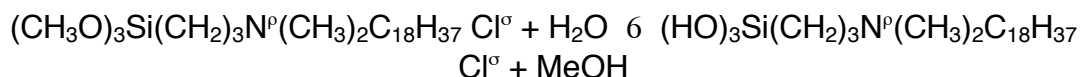
ZONOCIDE[®] CHEMISTRY

Zoonocide is prepared as a trialkoxysilane. Trialkoxysilanes undergo a wide variety of chemical reactions including transesterification, acetylation, halogenation, condensation and hydrolysis to name but a few. The most important of these reactions are hydrolysis (which is used to prepare Zoonocide) and condensation, (which is required for Zoonocide to bond to surfaces and form polymeric films).

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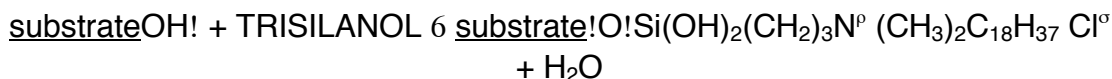
Hydrolysis of ODTA to Zoonocide

A. On contact with water molecules, the methoxy groups attached to the silicon atom in the ODTA molecule will react in a step-wise manner to form silanols.

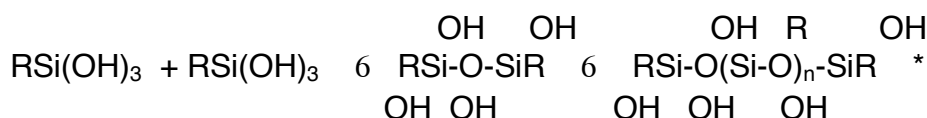


(In dilute aqueous solution, a stable solution is formed).

B. The Silanol moieties are very reactive and will react through a condensation type reaction with a wide variety of hydroxylated surfaces including cellulose, metals, sand, silica, zeolites, etc.

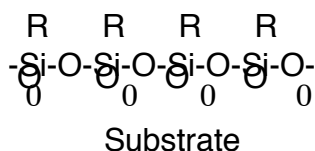


C. Silanol containing Zoonocide undergo autocondensation reactions with other Silanol substituted Zoonocide molecules and with the surface of a substrate, eliminating water.



Autocondensation occurs across the surface of substrates to produce 3-dimensional, cross-linked polymers being on the average 10-30 molecules thick, depending on the substrate.

Drying after application produces a durable, non-leaching, bonded, antimicrobial surface.



*where R = C₁₈H₃₇N^p(CH₃)₂CH₂CH₂CH₂Cl^o

GENERAL REACTIVITY OF ZOONOCIDE

Bonding and Deposition on Surfaces

Zoonocide will react with oxide and hydroxyl containing surfaces through a condensation reaction. The bonds formed are covalent and are resistant to rehydration. Coatings on siliceous materials (glass, sand) are removed by thermal means (>250°C) or concentrated chemical treatment (KOH, NaOH, HF). Durable coatings on metal are dependent on the metal substrate. Zoonocide coatings have been applied to textile fibres including cotton, cellulose acetate, polyester, nylon, wool, rayon, acrylon, etc.

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Durable coatings are readily applied to various natural and plastic surfaces including cotton, cellulose, wool, nylon, PVC, polyester, rayon, etc. Evaporation of the application media promotes T-resin film formation on the substrate. Electrostatic or H-bonding interactions provide bonding. Uniform film formation occurs through even “wetting” of the plastic surface. Durable films are achieved on nylon, fibreglass, epoxy, polyester, PVC substrates. Less durable films are obtained on PE and PP. Film formation on PTFE and other fluorinated substrates have not been reported.

GENERAL ZOONOCIDE[®] ANTIMICROBIAL CHEMISTRY

Zoonocide is a unique antimicrobial material. It forms a water stable solution at low concentrations. There are no additives in Zoonocide added to promote stability. This solution has the antimicrobial properties of typical aqueous solutions of quaternary ammonium compounds. On application to surfaces, the material reacts to produce a bonded antimicrobial coating. On evaporation of the water solvent, a durable bonded coating is produced which has improved and sustained antimicrobial properties. Zoonocide, when applied to a surface, transforms from a water soluble monomeric species to an insoluble, macromolecular antimicrobial film. This film is stable and durable.

Zoonocide has been demonstrated effective against a wide range of pathogens.

APPENDIX ONE

The following table lists the pathogens that are killed or inactivated following application of Zoonocide to various substrates and materials. This table does not reflect the activity of Zoonocide in the liquid form.

Pathogens Inactivated By Zoonocide Application

U.S. Patent No. 6,613,755 & Patents Pending

Gram Positive Bacteria	Reference
Bacillus sp. (vegetative cell)	5, 6, 11
Corynebacterium diphtheriae	1, 13
Micrococcus lutea	5, 6, 11
Micrococcus sp.	2, 5, 15
Mycobacterium tuberculosis	14
Mycobacterium smegmatis	14
Propionibacterium acnes	5
Staphylococcus aureus *	2, 3, 5, 6, 10, 11, 13, 24, 15,
21	
Staphylococcus epidermidis	2, 5, 6, 7, 11, 13, 14, 15
Streptococcus faecalis	2, 5, 6, 7, 11, 13, 14
Streptococcus mutans	5, 6, 7, 11
Streptococcus pneumonia	1
Streptococcus pyogenes	5, 6, 7, 11
Gram Negative Bacteria	
Acinetobacter calcoaceticus	2, 5, 6, 11, 14, 15
Aeromonas hydrophilia	5, 6, 11
Citrobacter deversus	5, 6, 11
Citrobacter freundii	5, 6, 11
Enterobacter aerogenes	5, 6, 7, 11
Enterobacter agglomerans	2, 5, 14, 15
Enterobacter cloacae	5, 6, 7, 11
Enterococcus	10
Escherichia coli	1, 2, 3, 5, 6, 7, 10, 11, 13, 14
Klebsiella oxytoca	5, 6, 11, 14
Klebsiella pneumoniae	3, 5, 6, 7, 9, 10, 11, 13, 14

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Klebsiella terriena	19
Legionella pneumophila	1
Morganella morganii	5, 6, 7, 11
Proteus mirabilis	5, 6, 7, 11
Proteus vulgaris	5, 6, 7, 11
Pseudomonas aeruginosa	2, 3, 5, 6, 7, 11, 13, 14
Pseudomonas fluorescens	5, 6, 7, 10, 11
Salmonella cholerae suis	5, 6, 7, 11, 14
Salmonella typhi	5, 6, 7, 11, 14
Salmonella typhimurium	1, 5, 6, 7, 11
Serratia liquifaciens	5, 6, 7, 11
Serratia marcescens	5, 6, 7, 11
Xanthomonas campestris	5, 6, 7, 11

Viruses

Adenovirus Type II & IV	17, 18, 21
Bovine Adenovirus Type I & IV	17, 18, 21
Feline pneumonitis	21
Herpes Simplex Type I	16, 17, 18
Herpes Simplex Type II	21
HIV-1 (AIDS)	21
Influenza A2 (Aichi)	17, 18, 21
Influenza A2 (Asian)	17, 18
Influenza B	17, 18
Mumps	17, 18
Parinfluenza (Sendai)	21
Rous Sarcoma	17, 18
Reovirus Type I	17, 18
Simian Virus 40	17, 18
Vaccinia	17, 18
MS2	19
PRD1	19

Fungi, Algae, Mould, Yeast, Spores

Alterania alternate	8,12
Aphanizomenon sp.	22
Aspergillus flavus	2, 5, 6, 7, 11, 14
Aspergillus niger	2, 5, 6, 7, 8, 11, 12, 13, 14
Aspergillus sydowii	5, 6, 7, 11

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Aspergillus terreus	5, 6, 7, 11, 14
Aspergillus versicolor	2, 5, 6, 7, 11
Aspergillus verrucaria	14
Aureobasidium pullans	5, 6, 7, 8, 11, 12
Candida albicans	1, 2, 5, 6, 7, 14
Candida pseudotropocalis	5, 6, 7, 11
Chaetomium globsum	1
Cladosporium cladosporioides	8, 12
Chlorella vulgaris	19
Dreschlera australiensis	8, 12
Epidermophyton sp.	9
Gliomastix cerealis	8, 12
Gloeophyllum trabeum	5, 6, 7, 11
Microsporium sp.	9
Microsporium audouinii	21
Monilia grisea	8, 12
Oscillatoria	20
Penicillium chrysogenum	5, 6, 7, 11
Pencillium commune	8, 12
Penicillium funiculosum	1, 2, 5, 6, 7, 11, 14
Penicillium pinophilium	5, 6, 7, 11
Penicillium variable	5, 6, 7, 11, 14
Phoma fimeti	8, 12
Pithomyces chartarum	8, 12
Poria placenta	5, 6, 7, 11
Scenedesmus	20
Saccharomyces cerevisiae	5, 6, 7, 11, 13, 14
Scolecobasidium humicola	8, 12
Selenastrum sp.	22
Trichoderma viride	5, 6, 7, 11
Trichophyton interdigitale	2, 14
Trichophyton maidson	14
Trichophyton mentogrophytes	5, 6, 7, 9, 11
Trichophyton sp.	9

Protozoa Parasites

Cryptosporidium parvum (oocysts)	19
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COMMERCIAL AVAILABILITY

Zoonocide is directly available from the **ZOONO AUSTRALIA PTY LTD**
Level 3 , 235 Broadway
Newmarket
Auckland

PO Box 9428
Newmarket

Phone + 64 9 280 4830
Fax + 64 9 524 4877
Email: info@zoono.com
Web: zoono.com

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The ZONO logo is located in the top right corner of the page. It consists of a dark blue square with a white diagonal line running from the top-left corner to the bottom-right corner. The word "ZONO" is written in white, uppercase letters in the bottom right corner of the square.

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