PreventX 24/7™ Antimicrobial Surface Protection vs "water based" Knockoffs

In the late 1990's and early 2000's, an effort was made to create a product that could compete with the efficacy of **PreventX 24/7™**. Several attempts were made, and a formula was discovered that simplified the production by removing the required methanol. Over the years companies have tried to compete in the marketplace by advertising this methanol free version of the quaternary silane, but most often quickly fail when they discover that the efficacy of the product fails to meet objective of providing a stable product to clients, that has long term residual effect on a surface.

The long-term chemical stability of **PreventX 24/7™** Antimicrobial Surface Protectant, 3-(trihydroxysilyl) propyldimethyl octadecyl ammonium, is due to the initial manufacturing of the molecule in methanol. The chemical structure of the active antimicrobial molecule is:

$$(MeO)_3\ Si\ (CH_2)_3\ N^+ C_{18}H_{37}Cl^- Me_2$$

This product when placed in water, quickly reacts to form a highly reactive intermediate as shown below:

Hydrolysis

(MeO)3 Si (CH2)3 N+ C18 H37 Cl- + H20 - (HO)3 Si (CH2)3 N• C18 H37 Cl- + MeOH Me2 Me2

As long as the methanol content is present, an equilibrium remains in place delaying the start of bonding to itself or other reaction sites. After contact with a substrate the following reaction, in which the antimicrobial forms a permanent covalent bond with itself and/or available reaction sites on the substrate becomes dominant. The reaction is driven by drying.

Condensation

$$(HO)_3Si\ CH_2CH_2\ CH_2\ N^{\bullet}\ C_{18}H_{37}.\ Cl^- \rightarrow (O_{1/2}\text{—}Si\ CH_2\ CH_2\ CH_2\ N^{\bullet}\ C_{18}\ H_{37})xCl^-\ Me_2\ O_{1/2}\quad Me2$$

The initial association to the substrate is probably made through the attraction of the positively charged cation to surfaces that exhibit a negative character in the aqueous media.

When the active antimicrobial is made from an aqueous phase (water based) formula rather than methanol, there is immediate self-polymerization from the monomer to a long chain polymer of the active antimicrobial, resulting in fewer reaction sites both to bond and attack microbes. This means that there is less activity of the formula, as it has begun to bond to itself. Over a short amount of time all of the active material will polymerize to itself. The three bonds of the methanol formula occur over a time, from immediately (once dried) for the first site and up to 29 days for the final bonding. During this time a rotation is occurring (the positively charged Nitrogen atoms and the octadecyl chains are constantly rotating in space) that allows for a uniform layer of antimicrobial protection. Again, the water-based product will not have this needed rotation. On direct contact with a microorganism the technology works by disrupting (or rupturing) the cell membrane. This interrupts the normal life processes and destroys the cell. Two forces cause the interruption: the quanternized Nitrogen acts as an electrocuting charge and the 18 carbon link chain acts as a sword. This structure is ideal for taking advantage of the anionic nature and the lipoprotein composition of microbial membranes. Since this antimicrobial acts only on the membrane and does not lose strength over time, it does not create the conditions which allow microorganisms to adapt to its presence or develop resistance.

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