MICROBE GUARD

Intro

Microbe Guards' Research and Development division partners with clients to solve unique application problems thus creating value added opportunities. Our patented water-based non-leaching antimicrobials deliver innovative and practical solutions for numerous global markets ranging from construction materials to textiles. Enhancing products to prevent stains, odors, and degradation by inhibiting microbial growth adds intrinsic value for our business partners.

Microbe Guard, Inc. is a significant player in the transition away from toxic biocides (including those containing heavy metals, phenols, and aldehydes) in the USA, Europe, and the Middle East, utilizing instead environmentally safe alternatives. In addition, these biocides are not chemically bonded to the product. Our patented water-based antimicrobial solution is bonded to the product producing a lasting effect. Microbe Guards' R&D chemists and microbiologists strive to improve efficacy while maintaining environmental friendly nature of our products thus boosting the value of our partner's products.

Microbe Guard R&D staff is experienced with GLP, ASTM, AATCC, AOAC, FDA, and proprietary efficacy procedures. We specialize in new product discovery and product development. Let Microbe Guards' expert R&D division assist your product development team with stain, odor, mold, and mildew protection.

EPA

Overcoming the regulatory hurdles faced by many companies eager to market a new product or service in the marketplace can be a challenging task. Even proven, advanced antimicrobial technology is closely scrutinized, and all resulting claims are carefully evaluated by regulatory agencies. Form submission guidelines, data collection and strict adherence to federal protocols must be observed throughout the entire process.

Our regulatory agency professionals and liaisons assist our clients in navigating the intricate process of legally registering new products or services. Our team automatically ensures that their annual commitments are satisfied to keep all obtained registrations and certifications current.

Regulations and requirements in North America alone can vary widely from state to state; the importance of submitting all necessary documentation and complying with all requests in the allotted timeframe cannot be understated.

By ensuring the timely and complete finalization of all necessary documentation, we allow our clients the freedom to focus on their priority: delivering and manufacturing an unsurpassed product or service without compromise or unnecessary delay.

UNDERSTANDING MICROBE GUARD ANTIMICROBIAL TECHNOLOGY WITH PERMANENTLY SURFACE-BONDED ANTIMICROBIAL ACTIVITY OF AN ORGANOSILICON QUATERNARY AMMONIUM CHLORIDE:

3-(Trimethoxysilyl)-Propyldimethyloctadecyl Ammonium Chloride
also known as Si-QAC

Background

All antimicrobial agents necessarily function by interacting with some component of the target cell. For instance, penicillin kills bacteria by shutting down a protein responsible for cell wall synthesis, thus interfering with its ability to synthesize the cell wall. The affected bacteria lengthen, but cannot divide. Eventually, the weak cell wall ruptures, resulting in the death of the cell. Today antimicrobial agents are more effective and can be delivered in a variety of ways. However, each is still dependant upon the principle of chemical reactivity with the cell or its components. And each requires dissociation of individual molecules and intimate involvement with one or more components of the life processes of the cell. Thus, even newer antimicrobial agents share the same limitations. The agent must leach or diffuse into the surrounding environment for association with a cell. This diffusion ultimately reduces the concentration below the effective dose, leading to resistance and adaptation. Moreover, the diffusion results in exposure consequences for humans and the environment.

During early 1970, researchers were in the midst of a large-scale screening project with the objective of identifying silicone and silane compounds that exhibited durable antimicrobial activity. A “problem” developed during the studies; everything the researchers tested seemed to be active. Even pure water showed potent antimicrobial activity. The source of the false positives was soon traced to the vessels in which the tests were being run. It seemed that the vessels had become “contaminated” by something that imparted antimicrobial activity to the vessel itself. Even extensive washing couldn’t remove the antimicrobial activity. Through a series of subsequent tests with new vessels, the source of the lingering activity was found to be coming from a particular silane-quaternary ammonium compound that had bonded to the surface of the vessel. This residual coating was unexpectedly potent, durable, and effective against numerous microorganisms including bacteria, yeast, algae, fungi, protozoa, molds, and some viruses.

The development of 3-(trimethoxysilyl) propyldimethyloctadecyl ammonium chloride (**Si-QAC**) represented a monumental advancement in the method of delivery of an antimicrobial. Using an alkoxysilane-coupling agent reacted to a quaternized amine, researchers were able to covalently link this novel antimicrobial monomer directly to a surface. The bound monomers then react with each other to form a cross-linked polymer of extremely high molecular weight and durability, thereby producing an essentially permanent antimicrobial surface. Through a series of radioisotope labeling and microbial assays researchers demonstrated that the antimicrobial activity did not result from release of the material and that it is a surface-associated phenomena.

The immobilization of an antimicrobial agent provides significant advantages over conventional antimicrobials. Since the activity is not dependant upon release and diffusion of the antimicrobial molecule, the activity remains constant over time. Moreover, the active molecule is localized in highly concentrated form on the treated surface. Since this is where proliferation of microbes occurs, the antimicrobial is effectively delivered specifically to the environment of importance. This not only extends the potency of the agent, but also minimizes the risk of the development of resistance. Indeed, scientists were able to demonstrate that resistance and adaptation does not occur. Moreover, the permanent attachment of the antimicrobial molecule to the surface avoids the potential exposure risks associated with conventional antimicrobials.

Si-QAC works through a two-step process. First, the hydrophobic alkyl chain inserts into the similarly hydrophobic cell wall of an organism that it comes in contact with. As the alkyl chain penetrates the delicate cell wall, the wall is weakened. Second, as the cationic quaternary ammonium group comes in contact with the cell wall it disrupts the ion flow and causes leakage into or out of the cell wall, usually resulting in the cell losing its contents or actually bursting. The charged quaternary ammonium alkyl group remains unchanged and is available to repeat the process indefinitely.

Si-QAC is much more potent than a non-silylated quaternary ammonium compound because the silyl group bonds to surfaces (and it self) and causes the antimicrobial portion to become locally concentrated. Thus, it is not a single molecule responsible for cell death, but an enormous amount of molecules all working in unison.

A significant limitation of **Si-QAC** was its instability in water. The coupling-portion of the molecule, an alkoxysilane, is necessarily reactive toward hydroxyl groups. This is what gives imparts the ability to bond to surfaces. However, the alkoxysilane is also reactive toward water and polymerizes to form a silicone polymer. Water solutions of the antimicrobial are unstable and degrade to a gummy precipitate within a matter of days. This was an enormous problem for the marketability of the product. The antimicrobial had to be supplied in a methanol-based solution and applied under carefully controlled conditions by certified applicators. Another drawback was the methanol solution is toxic, flammable and highly regulated.

Water Stabilized Si-QAC

In 1995, Dr. Lanny Liebeskind and Dr. Gary Allred of Emory University undertook the task to develop a safer and more environmentally friendly **Si-QAC.** This research developed a break through invention that offers the same bonding and efficacy of the methanol based Si-QAC with out the negative attributes of methanol. The research team was able to develop a system of stabilizing organosilane in water by giving the molecule an alternative to polymerization. **Si-QAC** stabilized by this new technology is shelf stable for years and still provides identical bonding and antimicrobial characteristics to surfaces. Moreover, the stabilization system results in a product that is stable at various pH and is compatible with a number of additives.

The nano-technology developed by these scientists offers tremendous significance on the practical usefulness of **Si-QAC** in today's earth friendly environment. Thus was born a much safer and easier to use **Si-QAC** which today Microbe Guard holds exclusive world wide patents and US EPA registrations and incorporates this technology through out its entire product line.

Patents

Microbe Guard's patented portfolio currently consists of three (3) U.S. patents, seven (7) foreign patents and several pending foreign patents. These patents will expire from 2018 to 2021 respectively. Our current patents cover 473 different compounds. New patent applications, if and when awarded, typically have a twenty (20) year effective term.

United States Patent *6,632,805*
Water-stabilized organosilane compounds and methods for using the same. The composition formed by mixing an organosilane, optionally having a nonhydrolizable organic group, but having one or more hydrolyzable groups, with a polyol containing at least two hydroxy groups, wherein at least any two of the hydroxy groups are separated by no more than two intervening atoms. Water-stabilized organosilane compounds. A water stable composition made from the polyol and organosilane or compound and water. A method of treating a substrate by mixing or contacting the substrate with the product compound, or composition of this invention for a period of time sufficient for treatment of the substrate. A treated substrate having adhered thereto the product, compound, or composition of this invention. A method of dyeing and treating a substrate. A method of antimicrobially treating a food article. A method of antimicrobially coating a fluid container. A method of antimicrobially coating a latex medical article. A method of making a siloxane in the presence of a stabilizer.

United States Patent *6,221,944*
Water-stabilized organosilane compounds and methods for using the same. The composition formed by mixing an organosilane, optionally having a nonhydrolizable organic group, but having one or more hydrolyzable groups, with a polyol containing at least two hydroxy groups, wherein at least any two of the hydroxy groups are separated by no more than two intervening atoms. Water-stabilized organosilane compounds. A water stable composition made from the polyol and organosilane or compound and water. A method of treating a substrate by mixing or contacting the substrate with the product compound, or composition of this invention for a period of time sufficient for treatment of the substrate. A treated substrate having adhered thereto the product, compound, or composition of this invention. A method of dyeing and treating a substrate. A method of antimicrobially treating a food article. A method of antimicrobially coating a fluid container. A method of antimicrobially coating a latex medical article. A method of making a siloxane in the presence of a stabilizer.

United States Patent *5,959,014*
Water-stabilized organosilane compounds and methods for using the same. The composition formed by mixing an organosilane, optionally having a nonhydrolizable organic group, but having one or more hydrolyzable groups, with a polyol containing at least two hydroxy groups, wherein at least any two of the hydroxy groups are separated by no more than two intervening atoms. Water-stabilized organosilane compounds. A water stable composition made from the polyol and organosilane or compound and water. A method of treating a substrate by mixing or contacting the substrate with the product compound, or composition of this invention for a period of time sufficient for treatment of the substrate. A treated substrate having adhered thereto the product, compound, or composition of this invention. A method of dyeing and treating a substrate. A method of antimicrobially treating a food article. A method of antimicrobially coating a fluid container. A method of antimicrobially coating a latex medical article. A method of making a siloxane in the presence of a stabilizer.