

## Company Name

Goldshield Technologies



## History

Goldshield Technologies was founded in 2008 by Mr Tom Higgins, an expert in textiles with extensive experience in the industry. Mr Higgins had developed a unique organosilane-based antimicrobial chemistry and founded the company to commercialize the technology. Unlike other organosilane-based technologies, the formulation is water-stable.

Prior to the invention, Mr Higgins was looking for antimicrobial technologies for the textile industry, particularly technologies that can prevent odor-causing bacteria and fungi. After several years of research, during which his father passed away from a hospital-acquired infection, Mr Higgins refocused his energy on a new aim - developing technologies to mitigate healthcare-associated infections caused by contaminated textiles and surfaces. Healthcare associated infections kill over 240 people every day in the USA with an **unrecoverable costs estimated to be \$80 billion** per year.

With the help of **one of the Deans** of Harvard Medical School and other doctors, Goldshield Technologies conducted early stage research to determine parameters such as which surfaces are able to be coated with antimicrobial technologies, how often they can be coated, how they can be coated, as well as the impact of each surface. Goldshield then sought independent validation of their technology in clinical trials at hospitals. The results of the trials have been peer reviewed and **published in the prestigious American Journal of Infection Control**. Such information is crucial for companies and technologies to be marketed into the healthcare industry.

## Technology

Goldshield have developed a water-based organosilane technology **with surface penetrating compounds**. The active compound consists of a silane base and a quaternary ammonium compound. This technology is the at the core of their GS 5 and GS 75 surface antimicrobials.

Through the inclusion of 3 hydroxyl groups into the organosilane, Goldshield have converted the organosilane from hydrophobic to hydrophilic. The polyol enables a stable water-based system that does not result in self-condensation of the organosilane. Goldshield's formulation does not include acids, solvents, and is not flammable. Goldshield's formulation can be easily applied via a regular spray bottle. It can also be applied via electrostatic spraying, where 1 gallon can cover 5,000 sq. ft, but outside of efficiency, electrostatic spraying is not necessary for application.

Additionally, the formulation includes a surface-penetrating compound that breaks down the interfacial tension of the surface. The concentration of this component is kept between 9 - 11 moles to keep the right pH of the

solution. If it is too acidic or too alkaline the silane moieties cannot bond to the surface. At the right concentration, the component allows the silane moiety to form non-polar covalent bonds with the substrate to be coated. Once this bond is formed, the antimicrobial coating does not become "fugitive" and is adhered to the surface.

The positive charge of the quaternary ammonium compound draws bacteria to the substrate.

The last component, a large carbon chain, disrupts bacterial cell walls and other microbial membranes through lysis. IDTechEx were told that this is the longest lasting component in Goldshield's formulation and is active for a minimum of 90 days. However, the overall product is not always marketed for 90-day application cycles. For example, places that experience high bioburden, such as hospitals, would be recommended to re-apply Goldshield every 30 days.

Goldshield's antimicrobial technology has been proven in 3 clinical trials that have been published in the American Journal of Infection Control. One of the studies is a 9-month study where Goldshield's coating was applied to 5 high-touch points in 18 intensive care units. Through investigating over 60,000 cultures, it was determined that Goldshield could reduce bioburden by 3 - 4 log. IDTechEx were told that Goldshield has run the only study that shows direct correlation between the use of chemistry on surfaces with reductions in healthcare associated infections.

Goldshield coatings have been used by NASA and have shown 100% biofilm reduction.



Goldshield's formulation can be applied using regular spray bottles. The company also offers large refill sizes of the coating.

Source: Goldshield Technologies

Goldshield have been investigating the application of their technology to personal protective equipment. This is because microorganisms are able to survive for long periods on textiles. For example, SARS-CoV-2 is known to survive on face masks for up to 7 days. Goldshield thus worked with one of their partners in China, who were applying Goldshield on masks, gloves and condoms, to test the ability of Goldshield-coated face masks to kill SARS-CoV-2. The study showed that face masks covered with Goldshield were able to deactivate 2.92 log of the virus vs the control group. This is equivalent to an inactivation rate of 99.88%. Furthermore, the masks showed residual activity for up to 3 days. Additionally, a previous study from 2015 showed that Goldshield-coated face masks can

remove 99.3% of bacteria. Goldshield will be continuing their research on application to other forms of PPE, with the goal of up to 5 - 7 logs reduction. This will close the infection control gap and allow PPE to work effectively in protecting the wearers and those around them. Otherwise, the PPE itself can become a vector of disease.

In addition to their core chemistry, Goldshield have developed a hand sanitizer and a broad-spectrum disinfectant.

The hand sanitizer is the same water-based chemistry as the surface coating. Similar to their surface coatings, Goldshield's hand sanitizer attaches to the skin (to the carbohydrates on the skin surface) and acts like an invisible glove. On the other hand, traditional alcohol-based sanitizers evaporate in 8-10 seconds and do not confer residual activity on the skin. IDTechEx were told that the hand sanitizer is currently selling very well in the USA both in healthcare and wider community such as assisted living facilities, nursing homes, schools, and even universities.

The company's broad-spectrum disinfectant offers 4 - 5 days residual biocidal activity on viruses and a cross section of both Gram-positive and Gram-negative bacteria.

Goldshield are now working closely with the EPA to develop a study protocol that can be used to effectively demonstrate residual activity of antimicrobial technologies. In particular, there has not been any study to demonstrate residual viricidal effect.

Prior to inventing the technology and founding Goldshield Technologies, Mr Higgins had investigated other antimicrobial technologies for textiles including phenolic chemistries, metals, and other organosilanes. However, each material had their own deficiencies. For example, metals not only leached out of textiles but also were deficient in their activity against fungi. Older organosilanes, invented in the early 1970s, utilized methanol as a solvent. The solvent is highly reactive and causes amines and silanes to react and form bonds. Thus, dimers and trimers are formed, and when dispersed, are neutralized. These chemicals cannot form a bond and thus do not achieve coverage of the substrate. Today, many organosilanes still utilize methanol as a solvent.

## **Business Model and Market**

Goldshield are active in B2B and B2C markets, selling to both via their website.

Goldshield has been building channels and are already widely applied in hospitals, outpatient clinics and assisted living facilities around the USA. They have now signed a network of distributors in the USA, including one which has over 70,000 customers in these healthcare-related fields. Goldshield is now aggressively marketing into that space through their distributors. Additionally, Goldshield are expanding their client base into transit facilities, utility companies and their vehicles, and have even worked with the Museum of Modern Art.

Currently Goldshield is exploring opportunities in the agriculture industry, with a focus on poultry. Consumers are increasingly resistant to poultry that have been injected with antibiotics. This has forced poultry farms to stop using antibiotics, but the result is a decrease in feed conversion and thus a decrease in income due to thinner birds. While disinfectants can deactivate microorganisms, they are not active in the presence of organic matter. As Goldshield can remain active even in the presence of organic matter, the hypothesis is that use of Goldshield in poultry grow houses should be able to increase feed conversion and prevent inventory loss.

Geographically, Goldshield serves customers in North America, Europe, Middle East, and parts of Africa. They are working with distributors in the Asian market and will be selling in all of ASEAN countries by the end of Q3 2020. Goldshield expects to enter the South American market by Q4 2020.