Burke Nelson, Ph.D. and Mai Ha, Ph.D.

The world is filled with microorganisms including disease-causing and object-damaging bacteria. Practically everything humans or animals touch – kitchen counters, bathroom fixtures, doorknobs, floors or medical equipment – is sure to have bacteria like *Escherchia coli* and *Staphylococcus aureus*, which can cause severe illness if surfaces aren't cleaned and disinfected regularly.

Take hospital beds, for example. Established criteria say that to be safe for humans, microbial flora on high-touch surfaces must not exceed 100 colony-forming units (CFU)/100cm2 potential pathogens and 250 CFU/100cm2 total microbial colony counts. Military sponsored research found that harsh disinfectants must be used every two hours to keep ICU bed rails below those levels of disease-causing bacteria, including Methicillin-resistant Staphylococcus aureus (MRSA), Vancomycin-resistant Enterococcus (VRE), two antibiotic-resistant strains of bacteria.[1] The researchers' primary conclusion: Hospital-approved disinfectants can quickly reduce bacteria counts to safe levels, but the bacteria rebound quickly to rise above 250 CFU/100cm2, and each bed rail must be re-disinfected every 120 minutes to maintain continuous, safe protection.

No one has the time or personnel to clean every surface in a hospital, shopping center, home, bathroom – or anywhere else – every two hours. Plus, disinfectants can contain harsh chemicals, including bleach and peroxide, which may cause respiratory irritation, be harmful if swallowed, injure bare skin, and damage or discolor the objects they're trying to treat.

http://www.cdc.gov/media/releases/2014/p0326-hospital-patients.html

Solution: Microban® SilverShield

Silver has long been used as an antimicrobial agent, at least since Hippocrates first described silver's antimicrobial properties in 400 B.C., but it wasn't until 1972 that scientists understood how silver works. Small amounts of silver disrupt bacteria's metabolism by preventing it from

converting nutrients into energy, which inhibits bacteria survival, reproduction and colonization.[2,3]

Microban's innovative SilverShield takes silver's proven antimicrobial effectiveness in polymers a huge step forward. Because of its unique geometry and highly efficient release mechanism, SilverShield reacts 8 times faster than other silver antimicrobials while maintaining polymer durability and integrity.

Testing shows that SilverShield provides 99% reduction of Salmonella enterica, E. coli, MRSA and VRE in 2 hours at room temperature, vs. up to 24 hours for competitors' products. Typically, objects can claim antimicrobial effectiveness with tests run at body temperature (37°C) over a 24-hour period, whereas SilverShield has been shown to reduce bacterial loads below safe levels within 2 hours at room temperature (25°C). These more rigorous criteria more closely approximate real-world use, where objects are far more likely to be at room temperature than body temperature.

SilverShield is not designed to replace a disinfectant, but rather complement the disinfectant in the fight against bacteria. Silver is constantly presented on the surface and ready to be released 24/7. This means that polymers with SilverShield offer continuous protection against bacteria, thereby helping to extend the effectiveness of disinfectant chemicals well beyond the 120 minutes before bacteria regain their foothold with disinfectants alone.

Microban SilverShield both complements and helps to extend the effectiveness of standard chemical disinfecting routines used in medical settings, homes and public spaces. Also, because it's embedded throughout polymers during the manufacturing process, SilverShield remains effective even if an object is nicked or scratched.

A Safe Alternative

SilverShield is inert until it comes into contact with a damp environment in which bacteria can proliferate. Only then will it release minute amounts of silver – just enough to inhibit the bacteria's metabolism and prevent reproduction. Its accuracy makes it a weapon in the ongoing battle against harmful microbes.

It is registered with the U.S. Environmental Protection Agency (EPA) as safe to use in a variety of applications including those that come in contact with food. Its small, uniquely shaped particles are designed to release silver ions faster than other silver-based products. Even though the particles are small, they are still too large to be considered a nanotechnology, which may alleviate the concerns of some consumers.

SilverShield's intelligence, unique geometry and EPA registration mean it's government approved as safe to use in objects that people or food can touch or can come in contact with. These qualities offer significant market advantages for SilverShield containing polymers.

SilverShield's Market Advantage for Polymers

Microban SilverShield's antimicrobial properties make products more appealing to cleanliness-conscious consumers and business buyers in a wide variety of industries, including health care

(e.g., hospital equipment) and construction/hardware (e.g., flooring, faucets, bathroom fixtures, countertops, etc.). Consumers perceive the Microban brand as a valuable trustmark that says they're getting durable and effective antimicrobial protection that doesn't negatively affect products' safety, integrity, functionality, aesthetics or durability.

Microban partners have successfully leveraged the Microban brand to grow their businesses by improving their pricing advantage, gaining or defending market share, enhancing product mix and securing new distribution.

How SilverShield Is Implemented

Microban works individually with polymer manufacturers to make SilverShield integration as simple and seamless as possible without disruption to existing manufacturing processes.

Our engineers develop customized formulations of SilverShield for each individual product. These custom formulations are tested with manufacturers' own polymers both for antimicrobial effectiveness and to ensure that SilverShield will not degrade or decrease the aesthetics or function of any part of the product. By providing SilverShield to manufacturers in masterbatches and training manufacturing staff on its proper use, Microban makes it very easy to properly insert SilverShield in polymers. Our regular and ongoing testing ensures that SilverShield continues to work over time, and our marketing services help manufacturers leverage the Microban name for market advantage.

Why Microban?

Microban International is the global leader for built-in antimicrobial protection. From pricing power to durability requirements to marketing support and patent counsel, Microban supplies clients with thorough and advanced services to help partners seamlessly deploy new antimicrobial technologies. Microban provides you with turnkey support including technical development, regulatory assistance, patent counsel, training, technical and marketing support to get your product to market quickly and effectively.

More than 250 smart companies are leveraging the Microban brand as an important differentiator to help grow their businesses.

---

[1]Attaway, Hubert H. et al. Intrinsic bacterial burden associated with intensive care unit hospital beds: Effects of disinfection on population recovery and mitigation of potential infection risk. American Journal of Infection Control, 2013; 40(10), 907-912.

[2]Jung, W. K., Koo, H. C., Kim, K. W., Shin, S., Kim, S. H., & Park, Y. H. (2008). Antibacterial activity and mechanism of action of the silver ion in Staphylococcus aureus and Escherichia coli. Applied and environmental microbiology, 2008; 74(7), 2171-2178.

[3]Morones-Ramirez, J., Winkler, J. A., Spina, C. S. & Collins, J.J. Silver Enhances Antibiotic Activity Against Gram-Negative Bacteria. Science Translational Medicine, 2013; 5(190), 190ra81. http://dx.doi.org/10.1126/scitranslmed.3006276