ISSA® Today

The Worldwide Cleaning Industry Association Publication

June 2016
www.issa.com

FACING THE HIGH TECH FUTURE

THE WAR ON GERMS GOES HIGH TECH

CLEANING JUST GOT SMARTER

THE POWER OF WATER

MARKET FOCUS: FLOOR CARE

ISSA Board Elections pg. 12

New Technologies in The War on Germs

By Mark Sisson

Whether you're a new mom, a human resource manager, or a hospital infection preventionist, illness caused by contagious pathogens is something that is universally dreaded. Scarier still, are the new strains of pathogens and antibiotic resistant bugs that seem to pop up over night.

The good news is there are more tools at our disposal to fight the war on germs than ever before. For example, more informative educational programs such as those provided by NanoBugs (www.nanobugs.com) are creating a deeper level of knowledge for everyone from health care workers to teachers and kids. Meanwhile, new technologies to fight this war is developing at a rapid pace.

With this in mind, take a look at the classes of technology and how they work followed by a look at some of the newest technologies themselves. (Warning: You might feel like you are in a science class but I assure the facts you read here will impress colleagues and customers alike!)

Traditional Antimicrobials

Sanitizers, disinfectants, and sterilizers all kill microbes, but differ in the list of pathogens they are effective against and their efficacy. Some antimicrobials target the cell wall. Since human cells don't have cell walls, these antimicrobials just target bacteria. Others target different aspects of a microbe's metabolic or reproductive systems, such as binding to their DNA/RNA or ribosomes. Also included in the broader category of germ killers are leaching poisons, such as Triclosan, which is often found in products like antibacterial soaps.

Heavy Metals

One of the oldest methods to kill germs is the use of heavy metals like silver and copper. Hippocrates wrote about the use of silver in treating wounds. Heavy metals rely on the oligodynamic effect where they react with thiol (SH) or amine (NH) groups of enzymes or proteins. The germ killing action of these metallic elements is dependent on the release of an ion, or charged particle, which damages the cell membrane and contents.

Textural Surfaces

Compared to some of the traditional approaches to killing germs, textural surfaces are like science fiction. One example is Sharklet, developed by Anthony Brennan, a material science professor at the University of Florida. His textural surface mimicked the surface of a shark's skin with millions of microscopic ribs. While Sharklet doesn't kill microbes, these ribs create nano forces that discourage bacteria from adhering to the surface. Another man-made textural surface is black silicon, modeled after the texture of dragonfly wings. Using sharp nano protrusions, this surface is one of the only approaches that kills bacteria through mechanical means—puncturing the cell wall.

UV Light

You know ultraviolet (UV) light disinfection has hit the mainstream when an industry leader like Clorox gets involved. These "robots" kill germs by using short-wavelength UV radiation (UV-C), which disrupts DNA. Since UV light is harmful to people as well as germs, these tools need to be used in an empty room. But it's not just hospitals that are using UV light. Boeing recently announced their new airplane bathroom that features UV light to disinfect the entire restroom in between uses. (*For more on UV technology, see "Seeing the Light" in* ISSA Today, *April 2016.)*

Nanotechnology and Photocatalytic Surfaces

Ever heard of a technology that is more than 40 years old but is considered state-of-the-art? Well, that would describe photocatalytic surfaces. These surfaces use a mineral nanocrystal as a catalyst, harnessing the power of light. The first practical application was discovered when researchers worked with titanium dioxide to decompose cyanide in drinking water in 1977. A fascinating aspect of a photocatalytic surface is that it creates two independent cleaning actions.

The first is an oxidation reaction that breaks down organic contaminants, including bacteria, viruses, fungi, spores, and even volatile organic compounds (VOCs). The second is the creation of hydroxyl radicals, one of the most powerful types of pathogen killers.

A weapon is only as good as its delivery mechanism

Traditional disinfectants need to be applied directly to surfaces in order to be effective. While there are some, like Quats (quaternary ammonium compounds) that have shown some persistent antimicrobial action, the vast majority of traditional antimicrobials are one-time kills and their effectiveness depends on cleaning staff following dosage and application instructions.

UV light systems offer a delivery mechanism that is less dependent on the diligence of cleaning staff. Companies like The CleanSweep Group (www.csgiusa.com) are using UV-C with clinically proven methodologies to dramatically reduce hospital acquired infections.

Photocatalytic surfaces can be the least dependent on the diligence of staff. Regardless of how these surfaces are deployed, they work continuously without human intervention—thus the frequently used term "self cleaning." For public facilities like office buildings, schools, physician and dental offices, nursing homes, and hotels, the focus has been on creating real-world applications for continuously self-cleaning surfaces that can be easily deployed exactly where they are needed. These surfaces would include skins for high-traffic touch points as well as portable surfaces, providing cleaner places to rest items wherever you go.

If you read my article in "The Psychology of Clean" in the last issue of *ISSA Today* (April 2016), you'll understand how important the visual communication of "clean" is in creating a perceived value in the eyes of customers, patients, students, and employees. One important aspect of photocatalytic surfaces is their ability to visually communicate clean.

Long-Term Impact

So we've got these powerful weapons, but in the process of killing germs, we don't want to introduce new health risks or harm the environment. One of the major health risks is antimicrobial resistance, or the creation of "superbugs." Using traditional antimicrobials with incorrect dosing or dwell times, not only do you risk having a surface that isn't really clean, but microbes that survive a weak disinfection process can develop resistance to that chemical or poison.

Photocatalytic nanotechnology, on the other hand, avoids many of these risks. Since the killing action is oxidation and hydroxyl radicals, there is no way to survive direct exposure and develop resistance. And unlike traditional disinfectants, the reaction created by photocatalytic surfaces oxidizes all organic contaminants, not just ones susceptible to a specific poison or chemical. From an environmental health standpoint, compounds like titanium dioxide that have not been shown to pose health risk to humans or the environment and are already in products from sunscreen to toothpaste to milk.

Research goes...toward the light

You're probably asking yourself why photocatalytic surface technology has been around for over 40 years, but you've never seen it used in everyday life. The answer is two pronged: First, most of the research has been conducted by scientists in a lab setting...what we would call "pure science." The problem with pure science is that it rarely leads directly to the creation of applications.. But now the time has come to move from pure science to "applied science" so we can find a way to connect the power of theoretical research to real world applications.

The second reason this technology has not been used much to date is that the oxidation reaction is so powerful, materials must be developed that can hold up as a delivery method. Plus, different materials and textures can have a dramatic impact on the efficacy of the photocatalyst, providing either a greater surface area for microbes to come in contact with or a texture that helps to prevent the buildup of biofilm.

As a testament to the industry potential for self-cleaning surfaces, NanoTouch Materials (www.nanoseptic.com) received a three-year, US$2 million research and development grant in 2015. This funding will be used to advance the science and improve efficacy, but more important, it will be used to conduct market research to identify specific applications and help guide product development.

The first nine months of the grant period unearthed some interesting developments. Specialty mineral primers and additives are leading to more durable surfaces for commercial applications, like skins for high traffic touch points and portable self-cleaning surfaces like mats for education and hospitality. And bonding other minerals to the nano molecules can dramatically improve efficacy. Historical tests by a variety of research organizations produced kill rates of 99.9% (3 log) in 24 hours. With the new materials, independently verified kill rates of 99.9998% (almost 6 log) are being produced. Equally exciting a large hospital in Saudi Arabia asked to test the technology against the human Coronavirus, a strain of which was causing the MERS outbreak and had a 40 percent mortality rate. After inoculating the self-cleaning surface with roughly 1 million virus cells, lab tests showed complete eradication in under 30 minutes. (We don't expect self-cleaning surfaces to work as rapidly as traditional disinfectants since self-cleaning surfaces are always on and disinfectants are one-time kill products.)

Looking forward, there's a continuous stream of discovery and innovation, which will lead to new tools, helping us to create cleaner, healthier environments. When it comes to cleaning for wellness, the future looks bright.

Mark Sisson is co-founder of NanoTouch Materials, which manufactures a line of self-cleaning NanoSeptic surfaces for facility management, health care, education, and food service. He can be reached at mark@nanoseptic.com or visit www.nanoseptic.com.