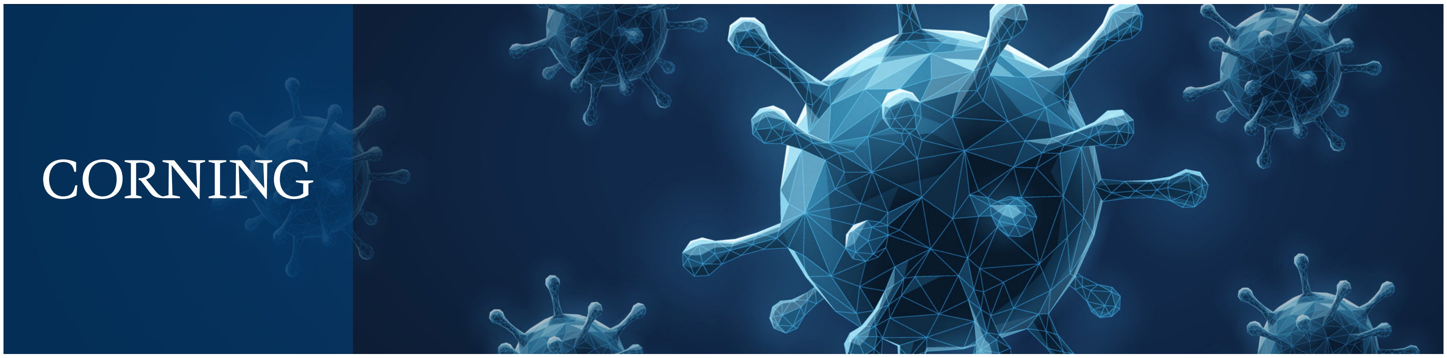

A Dry Test for Surfaces Addressing Real World Contamination

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Introduction

The rise of deadly viruses and antibiotic resistant strains of bacteria are currently of paramount concern in human health. The SARS-CoV-2 pandemic demonstrated how rapidly an unchecked and highly contagious virus can change life as we know it. As the world struggles to maintain some semblance of normalcy and prevent additional waves of outbreak, proper protocols must be in place to prevent the spread of the coronavirus in public and private spaces. Unfortunately, the virus can still easily be spread even with the use of face masks and social distancing measures. Though the primary mode of transmission is by person-to-person contact, the CDC warns that transmission could be possible through touching surfaces with the live virus.[1] Studies have shown that SARS-CoV-2 can live for hours to days on surfaces like countertops and doorknobs, depending on the composition of the surface.[2] So how do we reintroduce people to workplaces and public spaces knowing they will consistently touch the same door handles, tabletops, and other public surfaces?

Before this pandemic, self-sanitizing surfaces and antimicrobial paints were niche product categories. Now, businesses are actively looking for solutions to make their environments safer for customers and employees alike. Urban buildings, serving as homes and offices to millions of people, need more ways to reduce pathogens in high traffic areas. Schools, hospitals, childcare centers and elder care centers all need as many lines of defense as possible to prevent the spread of infection. Many people are still reluctant to leave their homes and resume everyday life, but the mainstream adoption of self-sanitizing surfaces can help. Surrounding ourselves with surfaces activated to inherently kill bacteria and viruses would alleviate fear and stress, bringing peace of mind to people returning to work and frequenting shared public spaces.

Testing Protocol: Wet Conditions versus Dry Conditions

To scale antimicrobial paints from their niche, a universally accepted and standardized protocol should be established. Products with antimicrobial qualities have claimed to inhibit microbial growth, but the strength of these claims is only as good as the protocol they use to make them. The most commonly cited testing standard used for self-sanitizing surfaces is a 'wet test' (JIS Z-2801). This test is meant to evaluate the efficiency of the surface's coating to inhibit the growth of microbes. It involves the use of a large volume of liquid, bacterial inoculum to keep the test surface wet throughout the experiment. The wet test is conducted at elevated temperatures of 37 ±4 °C and high humidity levels of > 80%. Under this testing protocol, a full 24 hours is allowed for active ingredients in the surface to kill the microbes being tested.[3]

Though the wet test can indicate efficacy of antimicrobial products, final reports are only representative of the testing environments described. Those parameters do not properly simulate the environment in which we live and in which we need antimicrobial surfaces to operate. In fact, studies have shown that certain biocides such as silver only become highly active at higher temperatures and humidity.[4] Think of an office environment where there may be shared office supplies, shared desktops, frequently touched door handles. Typically, the conditions in this setting are much different than those created by the wet test. Humidity and temperature are usually lower, the environment is dry, and the surface is likely infected with microbes more than once every 24 hours due to the frequency of use.

Universal adoption of a more accurate protocol would elevate the standard for self-sanitizing surfaces. A so-called 'dry-test' that more closely simulates everyday conditions and realistic contamination has been established by the United States Environmental Protection Agency[5]. This protocol is conducted at 23 ±4 °C (room temperature) and an ambient humidity of 40-50%. To pass dry test standards, a product must be effective enough to achieve full kill of the microbes on the surface in two hours or less. In October of 2020, the EPA issued updated guidance establishing an expedited review process to allow products faster access to claims against SARS-CoV-2 and expanded antimicrobial product categories to cover virus reduction claims on solid surfaces and paints as supplemental residual antimicrobial products.[6]

Despite wet test standards being unrepresentative of our realistic living conditions, many of today's common surface biocides rely on this protocol to conduct testing and validate claims. Multiple versions of the wet test have been established, including those that test for antibacterial efficacy of a surface (ISO 22196[7], JISZ 2801[3], and GB/T 21866[8]) and those that test for antiviral efficacy of a surface (ISO 21702[9]).

Superior Antimicrobial Efficacy of Copper

Silver is one of the most commonly used biocides to rely on this caliber of testing in order to reach full kill of microbes on its surface. Silver requires ample moisture, elevated temperature, and a sufficient quantity of ions to achieve the standard of >99.9% kill exhibited by other antimicrobial products.[4] Typically, antimicrobial products containing silver fail when tested against more realistic dry test standards. However, another well-known antimicrobial metal, copper, has been shown to pass the dry test.[4] Although there is debate regarding the chemical mechanism behind this phenomenon, there are still multiple experiments that prove copper is a more effective biocide for self-sanitizing surfaces. In an experiment performed by Michels, H T et al. under dry test conditions, three different types of surfaces were compared: a bare stainless-steel surface, a stainless-steel surface painted with an antimicrobial coating containing silver, and a variety of copper containing surfaces.[4] The results of the assay showed complete kill of the MRSA bacteria in about 75 minutes on the copper containing surfaces, while the surface with silver-based coating was still highly contaminated after six hours.[4]

Conclusion

To advance the market for self-sanitizing surfaces, it is necessary to adopt a dry test like the EPA protocol[5]. This testing method is far more practical than the traditional wet tests, better simulates real-world conditions, and helps focus the category of self-sanitizing surfaces on more efficacious materials like copper. In the coming months and years, there will be a much heavier reliance on antimicrobial products. Universal adoption of a more realistic test standard would help to expand use of antimicrobial technology beyond niche products to better address today's issues and benefit our global society.

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