

SURFACE COMPATIBILITY STUDY of Berkshire VersaHOCl®

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EXECUTIVE SUMMARY

Berkshire VersaHOCl®, although a highly effective antimicrobial agent, demonstrates superior compatibility with common cleanroom metal surfaces compared to traditional products. This study is conducted using carefully selected representative, sensitive surface materials and a protocol that simulates both extreme and routine use of antimicrobial agents in the cleanroom.

BACKGROUND

The active ingredients in common disinfectant products are known to cause irreversible damage to various metal surfaces found in controlled and industrial manufacturing environments. This damage not only shortens the lifespan of cleanroom components and increases operational costs, but it also likely harbors or sheds particulate contaminants that can directly affect the quality of products manufactured in these environments. Hypochlorous acid, a newer chlorine-based disinfectant, is highly potent even at low concentrations. Berkshire's VersaHOCl® is formulated to balance efficacy and surface safety through a proprietary blend. To compare the surface compatibility of VersaHOCl® with other common strong disinfectants on relevant surfaces, we examined its compatibility under two conditions. The first is an extreme or "worst case" scenario to evaluate how surfaces respond to prolonged exposure to disinfectant. We also investigated a continuous application scenario, in which disinfectants were sprayed onto and wiped from surfaces multiple times to simulate real-world use in manufacturing settings.

Berkshire
ENGINEERED CLEAN

METHODOLOGY

Test surfaces were selected based on market research and end-user questionnaires and sourced externally, while disinfectant products were either prepared internally at Berkshire or obtained from their manufacturers. For the extreme-use scenario, surfaces are submerged in the desired solution for 24 hours at room temperature. This scenario is designed to evaluate interactions between the disinfectant and the surface through intensive use.

For the continued application scenario, surfaces are treated with 3-4 sprays of each disinfectant and allowed to dwell for 10 minutes to replicate industrially relevant contact times based on label directions for use. After treatment, surfaces are wiped dry to remove the disinfectant, then cleaned with an IPA wipe to eliminate any residual disinfectant, in accordance with standard industrial cleaning procedures. This process is repeated 150 times to simulate real-world use conditions in manufacturing or commercial environments.

The cumulative effect is equivalent to at least 6 months in real life. For both the extreme and continued application scenarios, the coupons are evaluated for compatibility through visual and textural changes or interactions, and the results are recorded.

SUBSTANCES & MATERIALS

The following surface coupons were sourced in 6x6-inch squares:

- Zinc-Galvanized Low-Carbon Steel
- 6061 Aluminum
- 304 Stainless Steel

The following disinfectant solutions were sourced or prepared:

- Berkshire VersaHOCl® RTU.
- Peracetic acid 0.08% / Hydrogen peroxide 1% RTU
- Sodium hypochlorite (Bleach) 0.525% RTU

RESULTS

Pictures are presented below for visual representation

24 Hour Soak Test



VersaHOCl®
GALVANIZED STEEL



BLEACH 0.525%
GALVANIZED STEEL



PERACETIC ACID/HYDROGEN PEROXIDE
GALVANIZED STEEL



VersaHOCl®
STAINLESS STEEL



BLEACH 0.525%
STAINLESS STEEL



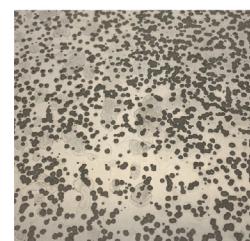
PERACETIC ACID/HYDROGEN PEROXIDE
STAINLESS STEEL



VersaHOCl®
ALUMINUM



BLEACH 0.525%
ALUMINUM



PERACETIC ACID/HYDROGEN PEROXIDE
ALUMINUM

For The Extreme Use Scenario:

- VersaHOCl® showed slight discoloration with galvanized steel and stainless steel, and no interaction with aluminum. Overall, the test indicated little to no reaction with the metal surfaces.
- Bleach 0.525% caused moderate discoloration and corrosion on galvanized steel, some rusting and corrosion on stainless steel, and significant corrosion of the aluminum surface.
- Peracetic acid/Hydrogen peroxide solution resulted in heavy rusting and corrosion of galvanized steel, severe pitting corrosion of aluminum, where holes formed in the surface, and no signs of interaction with stainless steel.

RESULTS

Pictures are presented below for visual representation

Continued Application Test



VersaHOCl®
GALVANIZED STEEL



BLEACH 0.525%
GALVANIZED STEEL



PERACETIC ACID/HYDROGEN PEROXIDE
GALVANIZED STEEL



VersaHOCl®
STAINLESS STEEL



BLEACH 0.525%
STAINLESS STEEL



PERACETIC ACID/HYDROGEN PEROXIDE
STAINLESS STEEL



VersaHOCl®
ALUMINUM



BLEACH 0.525%
ALUMINUM



PERACETIC ACID/HYDROGEN PEROXIDE
ALUMINUM

For The Continued Application Scenario, Continued Wipe Test:

- VersaHOCl® showed slight discoloration on galvanized steel, with no signs of interaction with stainless steel or aluminum. Overall, the test indicated minimal to no interaction with the metal surfaces.
- Bleach 0.525% caused low levels of rouging on stainless steel and moderate to significant discoloration of galvanized steel and aluminum.
- Peracetic acid/Hydrogen peroxide solution resulted in extensive rusting and corrosion of the galvanized steel coupon, severe corrosion, discoloration, and warping of the aluminum coupon, and no signs of interaction with stainless steel.

DISCUSSIONS

Visual and textural changes indicate interactions between the disinfectant and the metal surface. During the study, four main types of interaction were observed:

CORROSION – The general breakdown of the material caused by chemical reactions with the surrounding environment. Corrosion can be uniform or localized, and in extreme cases may present as pitting. It is a visible, textural sign of material degradation that can lead to serious issues, including structural failure due to weakening, equipment damage, and environmental contamination. Besides safety concerns, there are also economic and operational consequences, including higher repair and maintenance costs and reduced efficiency.

RUSTING – Rusting is a chemical reaction in which iron-containing metals react with oxygen and moisture to form iron oxide. It affects materials like iron and steel alloys. Rusting is a visible sign of degradation that can lead to significant problems, including compromised strength that may cause structural failure and environmental contamination. It shares similar economic and operational impacts as general corrosion.

ROUGING – Rouging appears as a reddish-brown discoloration of stainless steel caused by a film of iron oxide forming on the steel's outer passive layer. Although rouging does not pose the same structural risks as corrosion or rusting, it can lead to contamination, microbial growth, and signal future corrosion as the passive layer becomes uneven.

DISCOLORATION – An oxidative process where metal atoms react with oxygen or chlorine, resulting in visible, colored substances on the metal's surface. While discoloration generally does not present the same safety or operational risks, it can serve as an early sign of potential or future corrosion.

CONCLUSIONS

VersaHOCl® performed best across all three surfaces tested, both in the extreme and extended usage scenarios. The full ratings are listed below.

MATERIAL	BERKSHIRE VersaHOCl®	LEADING BLEACH PRODUCTS	LEADING PERACETIC ACID PRODUCTS
Aluminum	A	C	C
Galvanized Steel	A	B	C
Stainless Steel	A	C	A

A = Excellent. Minor to no interaction observed. Suitable for extended usage.

B = Fair. Corrosion and/or rouging observed after use.

C = Poor. Not recommended for long term use due to the substantial corrosion, rusting, or warping.