

The visual appearance of CuVerro® with regular cleaning

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Abstract

The visual appearance of CuVerro® alloys that are cleaned daily is influenced by the type of cleaner used. A four-week cleaning study compared visual changes amongst various hospital cleaners on brushed samples of CuVerro® Rose, CuVerro® White Bronze, and pure copper. Hydrogen peroxide based cleaner, *Clorox Healthcare™ Hydrogen Peroxide*, resulted in clean bright appearances on all surfaces over the course of the study. When cleaned daily with this cleaner, surfaces looked as bright as or brighter than a control surface not cleaned over the duration of the test. The alloys also exhibited little or no discoloration with 70% *Isopropyl Alcohol Wipes* and standard quaternary ammonium based cleaner, *Virex® II*. Conversely, CuVerro® and pure copper showed a darkening over time when cleaned with hypochlorite based cleaner, *Dispatch®*, on a daily basis. The alloys responded similarly to citric acid based cleaner, *CleanCide®*, becoming discolored and etched appearing though this depended on the drying method. An alcohol quat based cleaner, *PDI Super Sani-Cloth®*, also caused discoloration but not to the level of hypochlorite and citric acid cleaners. The study also found that, over the course of the evaluation, pure copper surfaces darkened more than CuVerro® surfaces.

Introduction

CuVerro® is a class of copper-based alloys that continuously kill bacteria¹ associated with healthcare-acquired infections. These surfaces represent the only class of EPA-registered solid surface materials that actively kill bacteria. CuVerro® is suited for commonly touched surfaces where transmitting infections are a concern. In healthcare, education, hospitality, and other public spaces, CuVerro® touch surfaces can complement routine cleaning and infection control practices to help keep the built environment continuously clean between cleanings.

Touch surfaces benefitting from CuVerro® are inherently visible surfaces. Routine cleaning should leave these surfaces appearing clean and visually appealing. Because CuVerro® alloys have actively exposed copper, the relationship between cleaning

and visual appeal is an important aspect in the choice of cleaners for CuVerro®. This study evaluated the compatibility of six standard hospital cleaners with CuVerro® from the perspective of visual appearance with routine cleaning.

Method

Four-inch square coupons of CuVerro® Rose-C706, CuVerro® White Bronze-C710, and pure copper-C110 were used. The test surface of each coupon was freshly brushed at the immediate start of the study by unidirectional abrasion with red Scotch-Brite® (Type A VFN aluminum oxide).

Photographs were taken of the coupons to represent their actual appearance. In addition to photographs, visual observations were made. One coupon of each alloy served as a control; it sat near the test coupons and was not cleaned.

The test coupons were cleaned individually in the afternoon of each weekday using one of six different hospital disinfectant cleaners. The cleaners are shown in Table 1. Pre-moistened disposable wipes were available and used for all cleaners except Virex® II. The Virex® II cleaner was prepared from a 256:1 concentrate because wipes were not available. The Virex® II was applied by spraying a microfiber cloth which was used to wipe the test coupons; the cloth was rinsed with water and air dried after each day of cleaning.

Cleaning was done following each manufacturer's

¹ Laboratory testing shows that, when cleaned regularly, CuVerro® kills greater than 99.9% of the following bacteria within 2 hours of exposure: VRE, MRSA, Staphylococcus aureus, Enterobacter aerogenes, Pseudomonas aeruginosa, and E. coli O157:H7. CuVerro® surfaces are a supplement to and not a substitute for standard infection control practices and have been shown to reduce microbial contamination, but do not necessarily prevent cross contamination; users must continue to follow all current infection control practices.

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Table 1. Standard hospital cleaners used in daily cleaning study

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- 1) Quaternary ammonium compound (QAC); *Virex® II*, 10 min contact time, label directions state "Wipe surfaces and let air dry."
 - 2) Hypochlorite (ClO⁻); *Dispatch® Hospital Cleaner Disinfectant Towels with Bleach*, 2 min contact time, label directions state "Wipe dry or allow to air dry."
 - 3) Hydrogen peroxide (HP); *Clorox Healthcare™ Hydrogen Peroxide Cleaner Disinfectant Wipes*, 5 min contact time, label directions state "Let air dry."
 - 4) Citric acid (CA); *Wexford Labs CleanCide®*, 10 min contact time, label directions state "Wipe or let air dry."
 - 5) Alcohol/quaternary ammonium compound (A/QAC); *PDI Super Sani-Cloth® Germicidal Disposable Wipes*, 2 min contact time, label directions state "Let air dry."
 - 6) Isopropyl alcohol (IPA); *Walgreens Isopropyl Alcohol Wipes 70%*, 15 sec contact time, no label directions for disinfecting hard surfaces
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label instructions. The wet contact time used for each cleaner is given in Table 1. The label instruction for the drying method of some cleaners specified air-dry while for others it specified wipe-dry *or* air-dry, as seen in Table 1. In this study, both types of drying method were used for each cleaner. With the air-dry method, coupons were allowed to air dry in ambient room atmosphere after the wet contact time had been achieved. With the wipe-dry method, coupons were wiped dry with a clean paper towel after the wet contact time had been achieved.

Results & Discussion

Photos of the test coupons after four weeks of cleaning are shown in Figs. 1 and 2 relative to the controls at four weeks. Fig. 1 shows results for air-dry and Fig. 2 shows results for wipe-dry. Visual observations of the test coupons relative to the controls are given in Tables 2 and 3 below the accompanying figures.

With the air-dry method, there were observations of various colors of stains ranging from white, gray, brown, to black. These stains were from the cleaners evaporating on the surface, leaving behind what appeared to be residue spotting. In most cases, these cleaned off with the next day's cleaning.

Notably, the surface area of the test coupons was small relative to the amount of liquid in the pre-moistened wipes or saturated cloth with each day's cleaning; because of this, there was a liberal amount

of cleaner on each coupon, likely much more than would be on surfaces in a real housekeeping setting. Residues were not seen with the wipe-dry method. This suggests the amount of residual liquid left on the surface after cleaning affects appearance.

The residue effect was especially evident with Clorox Hydrogen Peroxide and Dispatch®. Residual liquid of these cleaners in the air-dry method left an evident white film on the surface. With the wipe-dry method, where there was no visible residual liquid, the surfaces cleaned with these cleaners took on different appearances. The wipe-dry Clorox Hydrogen Peroxide surface was clean and bright – brighter than the control and appearing to be a fresh surface. The wipe-dry Dispatch® surface had a dark brown oxidized appearance.

Citric acid cleaner, CleanCide®, had a particularly aggressive effect on pure copper. Used as air-dry or wipe-dry, this cleaner turned pure copper dark and created an etched matte appearance. With CuVerro®, however, this cleaner exhibited a much less aggressive effect and surfaces appeared brighter when used as wipe-dry – in fact, for the higher nickel content CuVerro® White Bronze-C710, this cleaner produced a clean bright surface when used as wipe-dry.

The visual changes that arose over time with any of the cleaners were less pronounced for CuVerro® than pure copper. However, rankings of cleaners based on relative brightness and discoloration for each alloy were generally the same for CuVerro® as pure copper.

The cleaners that produced the brightest surfaces with the least observed color change were Clorox Hydrogen Peroxide, 70% Isopropyl Alcohol, and Virex® II. The cleaners that produced the darkest surfaces with the most observed color change were Dispatch® and CleanCide®. Super Sani-Cloth® produced results between the two extremes.

Rankings of the cleaners based on brightness and discoloration are shown in Table 4 for each alloy and method of drying.

Conclusions

Regular cleaning with hydrogen peroxide based cleaner, such as Clorox Hydrogen Peroxide, keeps CuVerro® looking clean and bright. Other cleaners that keep CuVerro® looking clean with regular cleaning are 70% Isopropyl Alcohol and quat based cleaner, Virex® II. An alcohol quat cleaner, such as Super Sani-Cloth®, maintains a clean appearance with some darkening over time.

Hypochlorite based cleaner, Dispatch®, and citric acid based cleaner, CleanCide®, cause darkening and discoloration of CuVerro® with regular cleaning. The effect of citric acid cleaner depends upon the

method of drying, however, as it actually produces a clean bright surface on CuVerro® White Bronze when used as wipe-dry.

The amount of residual liquid left on the surface after cleaning affects appearance. Cleaners left on the surface to air dry can leave a film and cause residue spotting.

Pure copper is more sensitive to cleaners that cause darkening and discoloration than CuVerro®.

Cleaners that cause darkening and discoloration of pure copper do so to a much lesser degree with CuVerro®. Overall, the degree of discoloration with CuVerro® is subtle relative to pure copper.

Author details

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CuVerro® is a registered trademark of GBC Metals, LLC, Virex® is a registered trademark of Diversey, Inc., Dispatch® is a registered trademark of The Clorox Company Corporation, CleanCide® is a registered trademark of Wexford Labs, Inc., Sani-Cloth® is a registered trademark of Professional Disposables International, Inc., and Scotch-Brite® is a registered trademark of 3M Company Corporation.

Fig. 1 – Photo results after four weeks with air-dry**Table 2.** Observations relative to control at four weeks for air-dry

Cleaner \ Alloy	C110	C706	C710
Clorox Hydrogen Peroxide (HP)	Color is a little brighter but has white and brown stains.	Color is good but white stains.	Color behind white stains same as control.
Isopropyl Alcohol (IPA)	Slightly darker.	Same as control; small dark spots.	Same as control.
Virex® II (QAC)	Brown stains.	Color behind white grayish stain is same as control.	Slightly darker color with gray/white stains.
Super Sani-Cloth® (A/QAC)	More orange color with greenish black stains.	Slightly darker; light gray stains.	Dark gray stains; color behind same as control.
CleanCide® (CA)	Much darker with grayish black stains.	Darker with dark gray stains.	Slightly darker gray stains.
Dispatch® (CIO-)	Darker with white spots and brown and black stains.	Slightly darker with white spots.	Darker with white spots.

Fig. 2 – Photo results after four weeks with wipe-dry

Alloy	Control	HP	IPA	QAC	A/QAC	CA	CIO-
C110							
C706							
C710							

Table 3. Observations relative to control at four weeks for wipe-dry

Cleaner \ Alloy	C110	C706	C710
Clorox Hydrogen Peroxide (HP)	Much brighter.	Slightly brighter.	Same as control.
Isopropyl Alcohol (IPA)	Slightly darker small brown stains.	Same as control.	Same as control.
Virex® II (QAC)	Slightly darker.	Same as control.	Same as control.
Super Sani-Cloth® (A/QAC)	Orange color.	Slightly darker.	Same as control but with brown stains.
CleanCide® (CA)	Darker with black spots.	Slightly darker; dull appearance with black stains.	Same as control.
Dispatch® (CIO-)	Brown color with black stains.	Darker with brown stains	Darker.

Table 4. Ranking of cleaners based on brightness and discoloration

	C110	C706	C710
	Air-dry		
Brightest/ Least darkening	HP IPA A/QAC QAC	HP IPA QAC A/QAC	IPA HP QAC A/QAC
Darkest/ Most darkening	CIO- CA	CIO- CA	CA CIO-
	Wipe-dry		
Brightest/ Least darkening	HP QAC IPA A/QAC	HP QAC IPA A/QAC	HP CA IPA QAC
Darkest/ Most darkening	CA CIO-	CA CIO-	A/QAC CIO-

Abbreviations: HP = hydrogen peroxide, IPA = isopropyl alcohol, QAC = quaternary ammonium compound, A/QAC = alcohol quat, CA = citric acid, and CIO- = hypochlorite.