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## Brief Report

## Effectiveness and real-world materials compatibility of a novel hydrogen peroxide disinfectant cleaner

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## Key Words:

Decontamination  
Clostridioides difficile  
Candida auris  
Sodium hypochlorite

## A B S T R A C T

A novel 4% hydrogen peroxide disinfectant was effective against methicillin-resistant *Staphylococcus aureus* (MRSA), *Clostridioides difficile* spores, carbapenem-resistant *Escherichia coli*, and 2 strains of *Candida auris*. In laboratory testing, a sodium hypochlorite disinfectant caused fading and loss of pliability of a hospital mattress, but the hydrogen peroxide disinfectant did not. These findings suggest that the hydrogen peroxide-based disinfectant may be a useful addition to the sporicidal disinfectant products available for use in health-care settings.

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In U.S. healthcare facilities, sporicidal disinfectants are commonly used in rooms of patients with *Clostridioides difficile* infection (CDI), whereas non-sporicidal disinfectants are typically used in non-CDI rooms.<sup>1</sup> Given concern that asymptomatic carriers may contribute to transmission of *C. difficile*, there is a potential rationale for use of sporicidal disinfectants in non-CDI rooms.<sup>2,3</sup> In recent studies, *C. difficile* has been cultured from 5% to 24% of non-CDI rooms after cleaning and disinfection.<sup>4,5</sup> However, many sporicidal disinfectants have limitations that discourage widespread use. Sodium hypochlorite (bleach) is corrosive and may be irritating to personnel and patients. Peracetic acid-based disinfectants have better materials compatibility but are relatively unstable with a short shelf-life.<sup>6</sup> Thus, there is a need for alternative disinfectants with activity against *C. difficile* spores.

Sani-HyPerCide disinfectant (Professional Disposables International, Woodcliff Lake, NJ) is a hydrogen peroxide-based spray or wipe disinfectant that has sporicidal activity in part due to generation of low concentrations of peracetic acid during use. The product has an Environmental Protection Agency (EPA) registration for many

vegetative pathogens with a 1 minute claim and for *C. difficile* spores with a 5 minute claim. In the current study, we evaluated the effectiveness and materials compatibility of the hydrogen peroxide disinfectant in comparison to 3 other disinfectants.

## METHODS

The disinfectants tested included Sani-HyPerCide disinfectant, Clorox Germicidal Bleach (Clorox Healthcare, Oakland, CA), OxyCide (EcoLab, Saint Paul, MN), and Oxivir 1 (Diversey, Fort Mill, South Carolina). The American Society for Testing and Materials standard quantitative carrier disk test method (ASTM E-2197-02) was used to test the efficacy of the disinfectants.<sup>7</sup> The exposure time was 1 minute and 5% fetal calf serum was used as a soil load. The test organisms included a clinical USA400 pulsed-field gel electrophoresis type methicillin-resistant *Staphylococcus aureus* (MRSA) strain, a clinical North American pulsed-field gel electrophoresis type 1 (NAP1) strain of *C. difficile*, a clinical carbapenem-resistant *Escherichia coli* strain, and 2 strains of *Candida auris*, including *C. auris* Antibiotic Resistance Bank (AR)-0385 (Clade IV; South America origin) and AR-0381 (Clade II; East Asia origin). *C. auris* isolates from the 2 clades were studied because a recent report suggested that a clade IV isolate of *C. auris* (AR 0385) was less susceptible to low concentrations of sodium hypochlorite than a clade II isolate (AR 0381).<sup>8</sup>

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**Table 1**  
Mean (Standard error) log<sub>10</sub> reductions in healthcare-associated pathogens using a quantitative carrier test with a 1 minute exposure time

Disinfectant	Ingredients	<i>C. difficile</i>	MRSA	Carbapenem-resistant- <i>Escherichia coli</i>	<i>Candida auris</i> AR 0381	<i>Candida auris</i> AR 0385
Sani-HyPerCide	4.04 % hydrogen peroxide, <10% acetic acid	4.7 (0.08)	≥6.4 (0)	≥5.6 (0)	>6.0 (0)	≥5.1 (0)
Clorox Healthcare bleach germicidal cleaner	Sodium hypochlorite 0.65%	≥6.7 (0)	≥6.4 (0)	≥5.6 (0)	≥6.1 (0)	≥6.6 (0)
OxyCide	Peracetic acid 0.13%, hydrogen peroxide 0.63%	≥5.0 (0)	≥5.48 (0)	≥5.6 (0)	≥5.1 (0)	≥5.1 (0)
Oxivir 1	Hydrogen peroxide >0.1% - <1%, benzyl alcohol 1%-5%	2.6 (0.3)	≥6.5 (0)	6.2 (0.3)	≥5.4 (0)	≥5.1 (0)

MRSA, methicillin-resistant *Staphylococcus aureus*; *C. difficile*, *Clostridioides difficile*; AR, Antibiotic Resistance Bank.

Testing was completed in triplicate. Log<sub>10</sub> colony-forming unit (CFU) reductions were calculated by comparing recovery from treated versus untreated control carriers. A 3-log<sub>10</sub> reduction with a 1 minute exposure time was considered adequate for clinical effectiveness.<sup>9</sup> The 1 minute exposure time was chosen because longer exposure times may be unrealistic in clinical settings.<sup>9</sup>

Materials compatibility testing was conducted using a bedside tabletop and a fluid resistant mattress (Drive DeVilbiss Healthcare mattress) that is used in patient rooms in the study hospital. The items were divided into five 20 cm wide sections, including 4 sections for the 4 disinfectants and 1 section for a water wipe (negative control). The disinfectants were wiped 130 times onto the surfaces using a saturated cotton cloth with air drying for at least 5 minutes between each application. The impact of the treatments was assessed visually with pictures taken to document visible changes and the mattress was manually palpated to assess for changes in texture and pliability.

## RESULTS

Table 1 shows the ingredients of the disinfectants tested and the mean log<sub>10</sub> reductions in the test organisms with 1 minute exposure time. Sani-HyPerCide disinfectant, Clorox Germicidal Bleach, and OxyCide reduced each of the test organisms by greater than 3 log<sub>10</sub>. Oxivir 1 reduced the MRSA, *C. auris*, and *E. coli* test strains by greater than 3 log<sub>10</sub> and reduced *C. difficile* spores by 2.6 log<sub>10</sub>.

After 130 disinfectant applications, Clorox Healthcare Bleach Germicidal Cleaner caused mild fading and loss of pliability of the mattress, but no adverse effects were observed on the tabletop. None of the other disinfectants caused visible adverse effects on the mattress or tabletop.

## DISCUSSION

We found that Sani-HyPerCide disinfectant, the new hydrogen-peroxide-based disinfectant, was effective against all the test pathogens. Clorox Germicidal Bleach and OxyCide had similar effectiveness. Oxivir 1 was effective against MRSA, *C. auris*, and *E. coli*, but not *C. difficile* spores, consistent with the fact that this product does not have a sporicidal claim. Clorox Germicidal Bleach caused fading and loss of pliability of a hospital mattress, but the other disinfectants did not. These findings suggest that the hydrogen peroxide-based disinfectant may be a useful addition to the sporicidal disinfectant products available for use in healthcare settings.

The hydrogen-peroxide-based disinfectant has potential advantages over some other sporicidal disinfectants. Our results suggest that the hydrogen-peroxide-based disinfectant has relatively good materials compatibility, including on soft surfaces such as mattresses. The disinfectant is stable with a long shelf-life and is ready-to-use with no requirement for dilution of a concentrate that might require special handling procedures. It has an EPA registered 1-minute claim against many vegetative pathogens. Although the disinfectant has a

5-minute EPA claim for *C. difficile* spores, we found that it was effective in reducing spores by > 3 log<sub>10</sub> within 1 minute.

All the disinfectants tested were effective against the emerging fungal pathogen *C. auris*, including a Clade IV South America origin isolate (AR-0385) that exhibited reduced susceptibility to low concentrations of sodium hypochlorite and ultraviolet-C light in comparison to a Clade II East Asia origin isolate (AR-0381).<sup>8,10</sup> The EPA has recently released a specific test method for evaluating the efficacy of liquid antimicrobials against *C. auris* (EPA MLB SOP MB-35-00).<sup>11</sup> Each of the tested disinfectants met the criteria of EPA MLB SOP MB-35-00 for efficacy based on a 5-log<sub>10</sub> reduction in *C. auris* AR-0381.<sup>11</sup> In addition, these disinfectants are on List P, a listing of antimicrobial products registered with EPA for claims against *Candida auris*.<sup>12</sup> Our results are consistent with previous studies that have demonstrated efficacy of sodium hypochlorite, peracetic acid, and hydrogen peroxide-based disinfectants against *C. auris*.<sup>8-9</sup> In contrast, water-based quaternary ammonium disinfectants have relatively limited activity against *C. auris*.<sup>8-9</sup>

## CONCLUSION

We found that a new hydrogen-peroxide-based disinfectant was effective against vegetative bacteria, *C. auris*, and *C. difficile* spores with a 1 minute exposure time. In laboratory testing, the disinfectant did not cause adverse effects on a bedside tabletop or hospital mattress. Further studies are needed to evaluate the effectiveness and materials compatibility of the disinfectant in healthcare settings.

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