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Actril® Cold Sterilants

Research Report: Clostridium Difficile Endospores and PAA Germicides

Introduction

Actril Cold Sterilant is a Peracetic Acid (PAA) based sterilant that has specific claims against even the hardiest class of organisms – spores. While Actril Cold Sterilant has been shown effective against the AOAC spore test organism – Bacillus subtilis – this white paper examines the effectiveness of current germicides, as well as, Actril Cold Sterilant against Clostridium difficile.

History Of C. difficile

While identified in the literature for over 70 years, C. difficile began to be increasingly recognized in the 1970s as an organism that had adapted and was becoming progressively more antibiotic resident. C. difficile is a spore forming, gram positive bacteria that is highly resistant to acidic environments such as seen in the gastrointestinal (GI) system. Because they can thrive in the intestinal tract, C. difficile releases toxins directly into the GI system, destroying the intestinal lining resulting in diarrhea and extreme dehydration.[1]

From 1999 to 2004, C. difficile related deaths almost quintupled with the death rate increasing by 35% per year in the United States.[2] In other nations, C. difficile has surpassed MRSA as the "superbug" of greatest concern in terms of numbers of deaths and continued growth rates.[3]

Germicides and C. difficile

C. difficile has two states: vegetative and endospore. In the vegetative state, C. difficile is readily destroyed by a large number of germicides such as quaternary ammoniums, dilute hypochlorite (bleach) solutions (1%), phenols, and alcohols.[4] In contrast, C. difficile in the endospore state is characterized by a thickened cell wall, which provides protection against drying-out and acidic environments. This cellular structure enables the C. difficile endospore to be resistant to the previously-mentioned germicides. In a study reported by Dr. William Rutala in 2006, the following disinfectants demonstrated no measurable activity at 20 minutes against C. difficile spores:

(1) Chlorhexadine,
(2) Vesphene (phenol),
(3) 70% isopropyl alchohol,
(4) 95% ethanol,
(5) 3% hydrogen peroxide,
(6) Clorox disinfecting spray (65% ethanol, 0.6% quaternary ammonium),
(7) Novaplus (10% povidone iodine) and
(8) Virox's Accel (0.5% hydrogen peroxide).[5]

In fact, in one study performed in England, two disinfectant compounds – quaternary ammonium and hydrogen peroxide – appeared to even encourage the growth of C. difficile spores.[6]

Actril vs. Spores

Actril Cold Sterilant is a broad spectrum germicide with sporicidal claims. In testing conducted under AOAC Sporicidal Test Protocols, Actril Cold Sterilant was successful with complete kill against Bacillus subtilis and Clostridium sporogenes.[8]

Actril Cold Sterilant has been shown to be effective against spores in general, a more specific test was conducted to look at its effectiveness in a short time period against C. difficile spores.[9] This test is summarized below:

Test Methodology: ASTM E 2197-02 – Conducted with ATCC 700792 (C. difficile spore)

Test Results: The inoculated carriers had a starting population of $4x10^5$ cfu. 10 carriers were exposed for 10 minutes to Actril solution. The results at the end of the ten minute period were:

Germicide	Carriers	% Reduction
Actril Cold Sterilant	10	99.999

Discussion

While a few antibiotic regimes such as vancomycin continue to be effective for the most part against C. difficile spores, good infection control practices dictate environmental reduction of the organism before infection. As previously indicated, not all germicides are effective against C. difficile spores and some may even promote growth.

In testing by Minntech Corporation, Actril Cold Sterilant significantly reduced the populations of C. difficile spores 99.999% and 99.9%, respectively.

References

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