Development of Novel Test Methods to Evaluate the Efficacy of Dry Sanitizer Products

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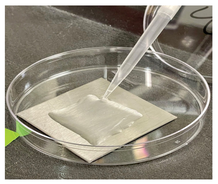
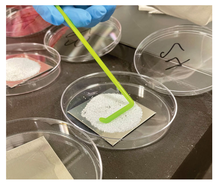
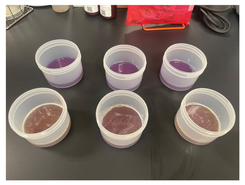
INTRODUCTION

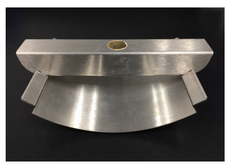
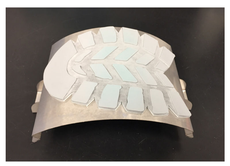
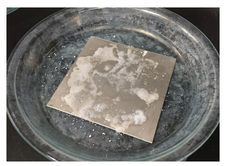
Dry sanitizers are used to control microbial pathogens present on the floors of food processing facilities and provide a barrier to reduce pathogen spread from one location to another. Standardized antimicrobial test methods are lacking for these types of products. Consequently, testing typically involves solubilizing the product in hard water and evaluating the product as a liquid. While regulatory agencies have accepted this type of data in the past to make claims (e.g., Non-Food Contact Sanitization), there is a reluctancy to do so in the future. Therefore, there is a need to develop new practical test methods that evaluate these products in ways that mimic their use. Not only can such tests serve as a framework for standardized methods and regulatory approved claims, they also allow for a better understanding of how these products work. This poster describes three test methods that were developed towards this goal.

METHODS

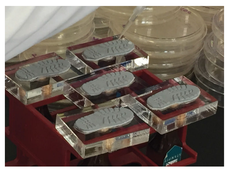
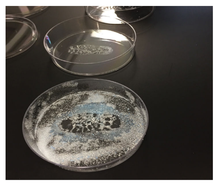
1. **Dry Sanitization:** Bacteria are dried onto stainless steel carriers followed by application of the test powder. The powder is wetted with sterile water and incubated under ambient conditions for 5 minutes. The carriers are neutralized (e.g., 2x D/E), serially diluted and spread plated to determine bacterial counts. The impact of ambient moisture activation is determined via the elimination of additional water. The powder-containing carriers are then incubated under controlled relative humidity and temperature, followed by neutralization and recovery.

2. **Continuous Dry Sanitization:** This method is a modification of the dry sanitization method and mimics the impact of wear and continued contamination. After the powder is applied, the carriers are subjected to a series of wear steps — alternately stamping a wet and dry boot stamp into the powder followed by bacterial inoculations. After 12 wear and inoculation cycles spread out over a 24 h period, the carriers are once again inoculated, and the efficacy of the residual powder determined as described above.

3. **Cross-Contamination Sanitization (Mini Boot Method):** Five boot stamps are inoculated with 10 drops of bacterial inoculum. The stamps are walked through a Petri dish containing powder, followed by 3 empty Petri dishes. After 5 minutes the empty Petri dishes are neutralized and the bacterial count determined by serial dilution and spread plating.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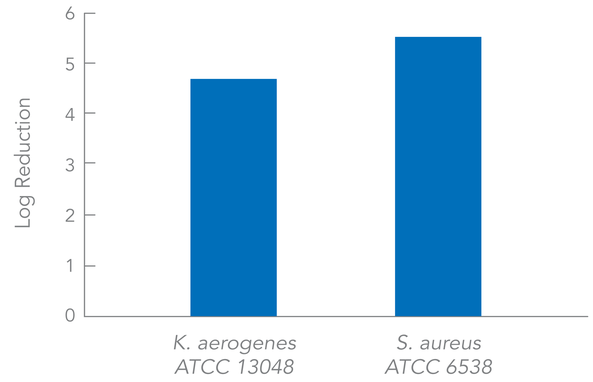
RESULTS

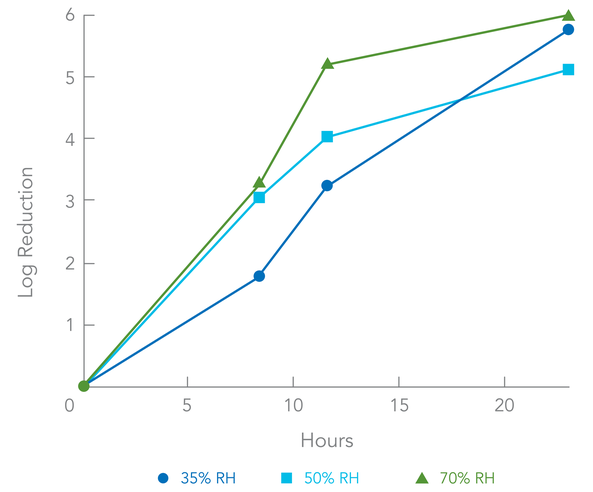
Figure 1 – Dry sanitization test results for water-activated quat powder



Application Rate: 0.37 oz (wt) of product + 0.97 fl oz water per sq foot

The addition of water results in a quick activation of the powder allowing > 4-log kill to be achieved in 5 minutes.

Figure 2 – Dry sanitization test results for ambient moisture activation of a quat powder against *Klebsiella aerogenes* ATCC 13048



Use Rate: 0.78 oz per sq foot

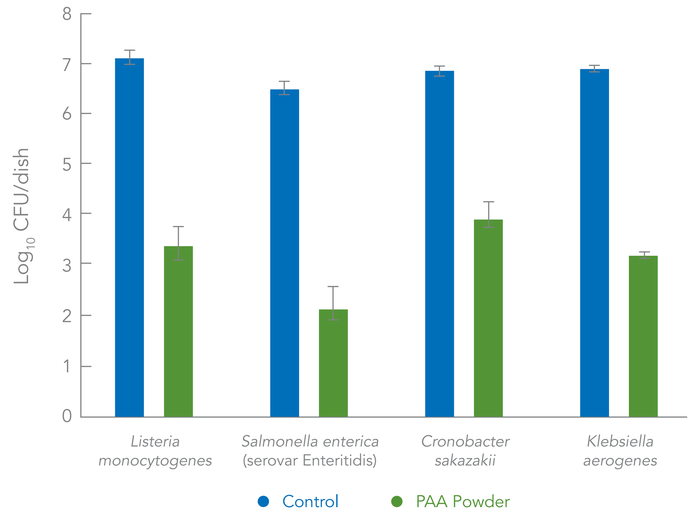
Log reductions in the presence of ambient moisture increase as the relative humidity (RH) increases. Sanitization levels of kill (> 3 logs) can be achieved even at lower RH but may require longer contact times (i.e., hours).

Table 1 – Continuous dry sanitization evaluation of three PAA powder formulations

Log Reduction (*S. aureus* ATCC 6538)					
Product	**Rep 1**	**Rep 2**	**Rep 3**	**Mean**	**SD**
Formula 1	3.56	3.90	4.20	3.89	0.32
Formula 2	3.83	5.19	5.06	4.69	0.75
Formula 3	4.23	4.23	4.19	4.22	0.02

Efficacy of the powders was maintained despite numerous dry and wet cycles. However, product/formulation comparisons can be difficult due to the low relative throughput of the method and variability.

Figure 3 – Cross-contamination sanitization test results for a PAA powder



Log reduction values (5 minutes) ranged from 3 to 4.4 depending on the organism. The variability between Petri dishes is relatively low making it easier for the relative comparison of products, formulations and organism type.

DISCUSSION/CONCLUSIONS

The methods described here have been used by our laboratory to evaluate dry sanitizer performance. The Dry Sanitization method with water activation is relatively easy to perform and mimics product application in a wet environment. Rapid activation of the powder can be achieved, with sanitization (> 3-log kill) occurring in minutes. When ambient moisture activation is utilized, longer contact times may be needed (i.e., hours) with RH having a significant impact on log reduction values and speed-of-kill.

The Continuous Dry Sanitization method was developed to evaluate product efficacy after the "wear and tear" of repeated foot or vehicle traffic. This method is the most cumbersome to perform and variability among repetitions can be problematic. Nevertheless, the residual efficacy of dry sanitizer products can be demonstrated with this method.

Neither of the above methods test for the prevention of cross contamination that can occur as foot and/or vehicle traffic moves from one part of a plant to another. The Cross Contamination Sanitization method was developed to address this. This relatively easy to perform method demonstrates how the spread of bacteria (in liquid droplets) can be reduced when those droplets are present on the surface of a boot or tire moving across the plant floor.

One or more of these methods could be standardized and adopted for industry-wide use. Once validated, the method(s) could be used to generate regulatory approved claims for dry sanitizers in a manner that more accurately reflects their use.

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