A Microbiological Evaluation of the Surface Cleaning and Disinfecting Properties of the Gates Mectrol PosiClean® Continuous Food Grade Belting

By
Nelson S. Slavik, Ph.D.
Environmental Health Management Systems, Inc.

Background

With increased concern over food safety it is imperative that the materials used in direct food handling and processing have properties that allow for adequate cleaning and disinfection. Products designed for the conveyance of meat and poultry products need to be specifically designed to facilitate cleaning to rid these large surface areas of meat residues, greases and oils and to allow for all meat contact surfaces to be disinfected. Conveyance belts have traditionally been designed in segmented, hinged configurations (modular belts) that allow ease of replacement and maintenance, minimizing downtime. However these modular conveyance belts due to their hinged design are difficult to clean and disinfect and if not properly cleaned and disinfected, the hinged area can become a reservoir of microbiological contamination.

Gates Mectrol has recently introduced its PosiClean continuous food-grade belting designed to be easily cleaned and disinfected. The belting is constructed of urethane that has been reinforced with sealed aramid tension members to minimize stretching which assists in preventing cracking. The material is extremely scratch/cut resistant and the belting features sealed edges and is welded endless or spliced with stainless steel or plastic lacing to facilitate cleaning and disinfecting.

This study was conducted to evaluate microbiologically the cleaning and disinfecting properties of the PosiClean belting material and provide a comparison to the cleaning and disinfecting properties of a widely used polyethylene, hinged modular conveyance material. Both materials were challenged with bacterial laden sausage, were cleaned and disinfected, and subsequently swabbed to determine remaining bacterial contamination. The results of this evaluation are contained in this paper.

Materials and Methods

Identical-sized samples of both the PosiClean material and the polyethylene, modular belted material (6 cm x 15 cm) were used in this comparison study. For the cleaning and disinfection studies, fresh sausage was smeared on each surface, enough to cover the entire area. After 20 minutes, a quaternary ammonium chloride disinfectant containing non-ionic surfactants (1:64 dilution of Metaquat™ manufactured by Spartan Chemical Company, Inc. Maumee, Ohio) was applied by spraying (~ 2ml) and the surface was immediately wiped using a paper towel. A second identical Metaquat spray application was performed and allowed to sit for ten minutes without wiping. This step was followed

by a spray application of warm water (30^0 C, ~3ml) to rinse away the second Metaquat application. The material was allowed to dry. The entire surface of each material was subsequently swabbed with a dry swab (QuickSwab®, 3M, Minneapolis Minnesota) followed by elution of the swab with 1.0 ml letheen broth (QuickSwab, 3M). The letheen broth sample was applied to a 3M Petrifilm plate and allowed to incubate at 37^0 C for 48 hours. The plates were visually counted and the number of colony forming units (CFUs) was recorded. The combination cleaning and disinfection studies were repeated six times for the PosiClean material and five times for the polyethylene, modular belt material. It should be noted that the Metaquat formulation contains only non-ionic surfactants and therefore the surfactant does not negatively interact with the active quaternary ammonium chloride germicidal agent (alkyl dimethyl benzyl ammonium chloride, final concentration 550 ppm).

For the surfactant only study, all procedures remained identical with the exception that the Metaquat solution was replaced by a 1:5 dilution of Tough on Grease™ (Spartan Chemical Company) which contained surfactants only. Both Metaquat and Tough on Grease contain surfactants having a high alkaline pH greater than 11.5.

Results and Discussion

Cleaning versus Cleaning/Disinfection

To validate the concept that cleaning alone does not rid material of bacterial contaminants, both the PosiClean and polyethylene, modular belt materials were subjected to a trial involving a surfactant without germicidal agent, Tough on Grease, and a concurrent trial subjecting the materials to Metaquat, a one-step degreaser and disinfectant. After the materials were subjected to either the degreasing only or the degreasing/disinfection procedure to remove all visible meat residues, the materials were swabbed to recover any remaining bacterial contamination originating from the sausage previous applied. See Plates 1 and 2. The results of this study are shown in Table I.

PLATE 1

Sausage Applied To PosiClean Material (Left), Modular Material (Right)

PLATE 2

After Cleaning/Disinfection Procedure – PosiClean on Left, Modular on Right

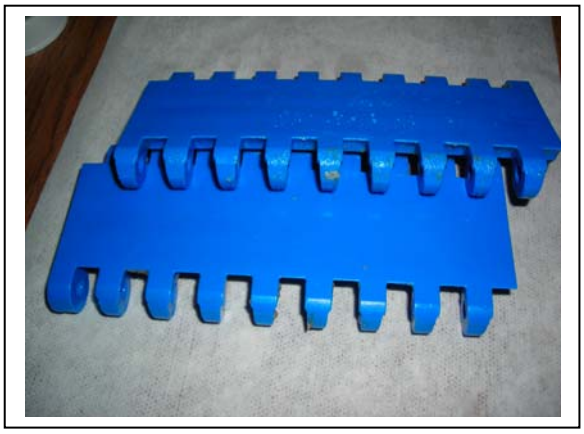


TABLE I

Remaining Bacterial Contamination After Degreasing Only
or Degreasing/Disinfection Procedure

	De-Greaser Only	De-Greaser/Disinfectant
PosiClean Belt	TMTC*/Plate	40 CFU's**/Plate
Polyethylene, Modular Belt	TMTC*/Plate	51 CFU's**/Plate

* Too Many To Count
** Colony Forming Units

The results clearly indicate that even if the surface appears clean, without the application of a disinfectant bacterial, counts remain extremely high. With the application of the quaternary ammonium chloride germicide after cleaning, the numbers of remaining bacteria are significantly reduced. The disinfection procedure results in less than one CFU per cm^2 of the materials tested (0.44 CFU/cm^2 and 0.55 CFU/cm^2, respectively for PosiClean and the modular belt materials).

Cleaning/Disinfection Comparison of PosiClean and the Polyethylene, Hinged Material
As indicated in the study comparing the bacterial inactivation efficacy of a degreasing procedure versus one using both a degreaser and a disinfectant, it appeared that both the modular belt and the PosiClean materials responded equally to cleaning/disinfecting procedure. To verify this observation, both the PosiClean and the modular belt materials were cleaned/disinfected with Metaquat, water rinsed, swabbed, and plated for residual bacterial contamination. The results of these studies are shown in Table II. Typical Petrifilm results are shown in Plate 3. It should be noted that rinsing with non-sterile water does contribute to some added bacterial contamination, but that contribution averaged only 3 CFU's in the four rinse control trials conducted (range 7 to 22 CFU's).

TABLE II

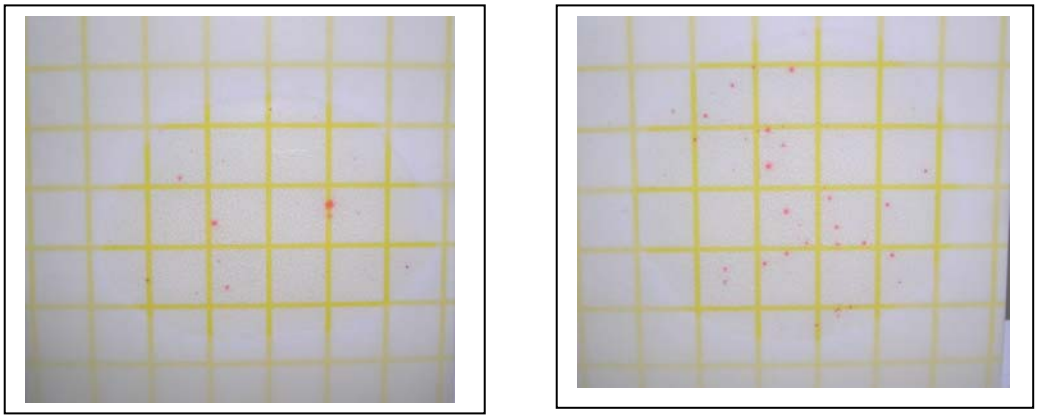
Residual Bacterial Contamination

	Average CFU/Plate	CFU/Plate Range	CFU/CM^2 *
PosiClean Belt	25	12-46	0.13
Polyethylene, Modular Belt	61	21-127	0.53

*After subtraction of water rinse contamination control (13 CFU)

PLATE 3

Typical Petrifilm Plates of Bacterial Counts After Cleaning/Disinfection – PosiClean on Left, Modular on Right



As seen in Table II both the PosiClean and the modular belt materials responded equally well to the cleaning/disinfecting procedures employed (on the horizontal surfaces only) and both averaged less than one CFU per cm^2 of the material (90 cm^2 for each material sample) tested for bacterial contamination remaining after the cleaning/disinfection procedure.

However, the modular belt material is hinged along the full width of each belt module providing a significant surface area difficult to clean and disinfect. In sections provided for testing, hinged surface areas represented 42% of the total surface area that would require cleaning and disinfecting due to its proximity to conveyed meat or poultry products. As shown in Plate 4, meat residues can easily accumulate in the hinged area of a modular belt and even after the cleaning/disinfectant process meat residues still are retained in the hinged recesses.

PLATE 4

Meat Residues Remaining in Hinged Areas After Cleaning/Disinfection

An evaluation was conducted of the efficacy of bacterial removal within the hinged section of the modular belt using the cleaning/disinfecting methods employed in this study. After the cleaning/disinfection process was completed, the two sections were separated and the hinged areas swabbed for bacterial contamination. The results of that study are presented in Table III.

TABLE III

Microbiological Analysis of Hinged Area After Cleaning/Disinfecting on Modular Belt

	Trial 1- CFU's*/Plate	Trial 2 – CFU's*/Plate
Both Flat Surface Areas	122	92
Hinge Post	8	4
Hinge Rings	TMTC**	TMTC**

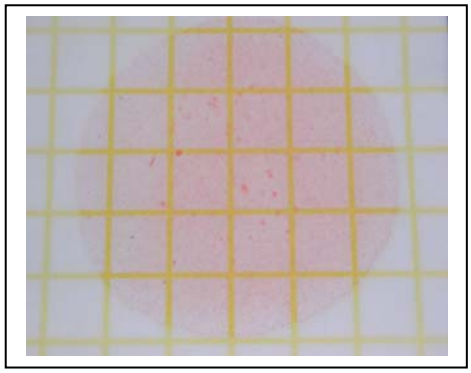
* Colony Forming Units
** Too Many To Count

As demonstrated, the effectiveness of bacterial inactivation for the two adjacent flat surfaces of the modular belt was less than one CFU per cm^2 after treatment for each trial (i.e., 122 CFU/180 cm^2 and 92 CFU/180 cm^2 for Trials 1 and 2, respectively). The hinge posts had minimal contamination as was expected since the posts are physically removed from direct contamination when holding the two modular sections together. However, the microbial contamination within the hinge areas was significant as indicated by bacterial

overgrowth (visualized as red/pink hue throughout plating area) on the Petrifilm plates for each trial. See Plate 5. This result was expected since meat residues were visible after the cleaning/disinfection process. See Plate 4 above.

PLATE 5

Petrifilm Plate of Bacterial Counts on Hinge
After Cleaning/Disinfection Modular Material



Conclusions

The following conclusions can be extracted from these studies:

- A germicidal agent is required to rid both the PosiClean and the modular belting materials of bacterial contamination after a thorough cleaning process. The application of a degreaser or detergent alone is not sufficient to reduce bacterial contamination.
- Both the PosiClean (urethane) and modular (polyethylene) belting materials clean and disinfect similarly in the bench top tests conducted on these materials. Both materials were adequately disinfected after cleaning to less than 1 CFU/cm^2 on the flat horizontal surfaces.
- Hinged areas of the modular belt material were difficult to clean and harbored meat residues after completion of the cleaning/disinfection process. Microbiological analysis of the hinged areas revealed significant microbiological contamination.

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Author

Nelson S. Slavik is president of Environmental Health Management Systems, Inc., Niles, Michigan, USA and holds a Ph.D. in Microbiology from the University of Illinois at Urbana-Champaign. He has authored over 80 articles on environmental and occupational safety legislation, regulations, and their application within the healthcare industry and he additionally consults with the food industry on microbiological safety issues and efficacy of germicidal treatment of reusable and disposal products.