

MICROSURE ANTIMICROBIAL LAUNDRY SOLUTION AND TEXTILE WASHING:

Summary of Antimicrobial Efficacy Associated with Commercial Washes

Abstract

A series of tests were performed using *Microsure Antimicrobial Laundry Solution* as an adjunct in commercial grade washing machines on various textiles cultured with *Klebsiella* (KLEB), one of the most common bacteria recorded. The samples consisted of standard military textiles, including socks, medical scrub tops, long-sleeve shirts, cotton towels, underwear, uniforms, and more. Observations were performed to assess satisfactory (>85%) antimicrobial residual effectiveness after each washing cycle and results were recorded.

Introduction

Historically, bacteria have been the root cause for some of the most lethal diseases and infectious processes identified throughout civilization. Unfortunately, bacteria and other harmful microscopic organisms can effortlessly travel, adhere, and invade various textiles. Consequently, placing individuals at risk for infection and contamination. Textiles are widely used in both household and workplace settings, they possess an assortment of uses, the most common of which being clothing. Individuals encounter countless textiles throughout each day, whether it's the outfit they choose to wear, the towel they dry themselves with after showering, or the bed linens they use while sleeping, there simply is no way of avoiding contact with textiles. With that said, it is easy to imagine how bacteria can make their way onto a variety of textiles and in turn result in human exposure. The purpose of this literature is to summarize the outcomes of numerous experiments as they relate to antimicrobial efficacy on various fabrics when using *Microsure Antimicrobial Laundry Solution* in commercial grade washings.

Testing Protocol

The process for each of the tested textiles followed the exact same procedure. All samples were treated using exhausting method. The general step by step procedures utilized for the treatment of samples has been provided.

**Notes:*

-Each commercial wash mentioned throughout this literature was determined as being equivalent to five domestic wash cycles.
-All samples were tested for antimicrobial efficacy before and after each commercial wash.

- 1.) Each textile sample was placed into an overnight culture of KLEB (ATCC-4352) that was adjusted in concentration to an absorbance of 0.28 at 475 nm; the standard absorbance that is typical for a 10^8 CFU/ml concentration of bacteria.
- 2.) A set amount of culture broth was diluted into a set amount of nutrient broth in order to create a working solution that was then placed in a flask for an initial starting point of zero contact time.
- 3.) Textile samples were then weighed out
- 4.) Set amounts of the Microsure antimicrobial solution were placed in water, forming a treatment bath. This treatment about was tested using a percentage based on weight of goods (OWG)
- 5.) Washing was tested using separate dilution ratios and samples were dried completely, according to specific protocol test methods.
- 6.) Textile samples were then transferred to solution so that the number of surviving bacteria could be examined.

- 7.) Efficacy was measured by percentage and documented.
- 8.) Samples were then incubated overnight at 35 degrees Celsius and colonies were counted the next day prior to each additional wash cycle.

- 9.) This process was repeated up to 100 Commercial wash cycles or until efficacy fell below 85%.

Results

**Note: Once the measured efficacy reached below 85%, Microsure antimicrobial solution was no longer considered effective.*

Antimicrobial Efficacy of Test#: 022012-1
-BLUE MEDICAL SCRUB TOP
(microfiber 45%; polyester 35%; Cotton 20%)

| Sample ID | 022012-1 | 022012-1 | 022012-1 |
|----------------------|---|---|---|
| Costumer | "BRAND" Medical Textile | "BRAND" Medical Textile | "BRAND" Medical Textile |
| Specifications | Blue Polyester Microfibre 45%; Polyester Spun 35%; Cotton 20% | Blue Polyester Microfibre 45%; Polyester Spun 35%; Cotton 20% | Blue Polyester Microfibre 45%; Polyester Spun 35%; Cotton 20% |
| Results After Washes | Initial | 75 Washes | 100 washes |
| Concentration | xx | 10% | 10% |
| 0 Time | | | |
| Dilution Factor | Inoculum Only | T3 | T1 |
| 1 | xx | xx | xx |
| 1 | xx | xx | xx |
| 10 | xx | xx | xx |
| 10 | xx | xx | xx |
| 100 | 259 | 115 | 195 |
| 100 | 269 | 112 | 210 |
| | | | |
| 60 Minute | | | |
| Dilution Factor | Inoculum Only | T3 | T1 |
| 1 | xx | 110 | xx |
| 1 | xx | 110 | xx |
| 10 | xx | 4 | xx |
| 10 | xx | 0 | xx |
| 100 | 144 | 0 | 75 |
| 100 | 136 | 0 | 65 |
| | | | |
| Reduction | 34% | >99% | 65% |
| CONCLUSION | | Pass | Fail |

Findings:

Samples treated at 10% on weighted average (OWG) showed excellent antimicrobial efficacy before and after washing up to 75 commercial launderings.

Antimicrobial Efficacy of Test#: 112011-47
-BLACK LONG SLEEVE CREW NECK SHIRT
(POLYPROPYLENE 100%)

| 102012 - 48.2 | 102012 - 48.2 | 102012 - 48.1 |
|--|----------------------------------|--------------------------|
| "BRAND" Military Textile | "BRAND" Military Textile | "BRAND" Military Textile |
| 2. 100% Polypropylene Series 101 | 2. 100% Polypropylene Series 101 | 1. 100% Polyester |
| DETERMINE OPTIMAL LEVEL OF (2015 - 39104120) FOR ANTIMICROBIAL EFFECTIVENESS AFTER TREATMENT AND RESIDUAL EFFECTIVENESS AFTER 50 WASHES. | | AFTER 50 WASHES |
| 5% | 10% | 5% |
| T1 (0.5% OWG) | T3 (1.0% OWG) | T1 |
| xx | xx | xx |
| 68 | 77 | 79 |
| 59 | 69 | 81 |
| T1 | T3 | T1 |
| 15 | 5 | 2 |
| 14 | 3 | 1 |
| 1 | 4 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| >99% | >99% | >99% |
| Pass | Pass | Pass |

Findings:

The samples treated at 0.5% OWG showed EXCELLENT Initial antimicrobial efficacy of >99%. The samples treated at 1.0% on weight of goods (OWG) showed EXCELLENT initial anti-microbial efficacy of >99%. The samples washed 50 times at 0.5% OWG showed excellent antimicrobial efficacy of >99%.

Antimicrobial Efficacy of Test#: 'TALL' BROWN SOCKS
(cotton blend)

| Brand Costumer | | | |
|----------------------|-------------------------|-------------------------|-------------------------|
| Specifications | "TALL" Brand Brown Sock | "TALL" Brand Brown Sock | "TALL" Brand Brown Sock |
| Results After Washes | Untreated Control | initial | 30 washes |
| 0 Time | 0 Time | 0 Time | 24 Hours |
| Dilution Factor | Inoculum Only | T1 | Inoculum Only |
| 1 | xx | xx | xx |
| 1 | xx | xx | xx |
| 10 | xx | xx | xx |
| 10 | xx | xx | xx |
| 100 | 139 | 148 | 84 |
| 100 | 151 | 148 | 96 |
| 60 Minute | | | |
| Dilution Factor | Inoculum Only | T1 | T3 |
| 1 | xx | xx | xx |
| 1 | xx | xx | xx |
| 10 | xx | 24 | 64 |
| 10 | xx | 20 | 77 |
| 100 | 144 | 3 | 7 |
| 100 | 136 | 0 | 5 |
| Reduction | | >99% | 93% |
| CONCLUSION | | Pass | Pass |

Findings

The textile samples showed excellent anti-microbial efficacy before and after 30 washes.

Antimicrobial Efficacy of Test#: 112011-40
-WHITE COTTON BATH TOWEL

| Sample ID | 112011 - 40 | 112011 - 40 | 112011 - 40 | 112011 - 40 | 112011 - 40 | 112011 - 40 | 112011 - 40 | 112011 - 40 | 112011 - 40 |
|---------------------------|---|---|---|---|---|---|---|---|---|
| Costumer | "BRAND" Textile |
| Specifications | White Bath Towel |
| Comment/ Conditions | Hydrophillic Silicone Finishing |
| Results After Washes | passed at 0.25 OWG and 0.5% OWG after 50 washes | passed at 0.25 OWG and 0.5% OWG after 50 washes | passed at 0.25 OWG and 0.5% OWG after 50 washes | passed at 0.25 OWG and 0.5% OWG after 50 washes | passed at 0.25 OWG and 0.5% OWG after 50 washes | passed at 0.25 OWG and 0.5% OWG after 50 washes | passed at 0.25 OWG and 0.5% OWG after 50 washes | passed at 0.25 OWG and 0.5% OWG after 50 washes | passed at 0.25 OWG and 0.5% OWG after 50 washes |
| Description | 1/10/2012 | 1/13/2012 | No Washing | No Washing | No Washing | 50 Washes | 50 Washes | 50 Washes | 50 Washes |
| 0 Time | Inoculums Only | Control | T1 (0.25%) OWG | T2 (0.50%) OWG | T3 (0.75%) OWG | Inoculums Only | Control | T1 (0.25%) OWG | T2 (0.50%) OWG |
| Dilution Factor | xx |
| 1.00 | xx |
| 1.00 | 88 | 34 | 88 | 51 | 111 | xx | xx | xx | xx |
| 10.00 | 68 | 64 | 78 | 42 | 79 | xx | xx | xx | xx |
| 10.00 | 9 | 8 | 11 | 5 | 9 | 88 | 100 | 215 | 191 |
| 100.00 | 12 | 9 | 12 | 6 | 11 | 80 | 181 | 225 | 201 |
| 100.00 | xx |
| 60 Minute Dilution Factor | Inoculums Only | Control | T1 (0.25%) OWG | T2 (0.50%) OWG | T3 (0.75%) OWG | Inoculums Only | Control | T1 (0.25%) OWG | T2 (0.50%) OWG |
| 1 | xx | xx | 0 | 0 | 0 | xx | xx | xx | xx |
| 1 | xx | xx | 0 | 0 | 0 | xx | xx | xx | xx |
| 10 | 71 | 205 | 0 | 0 | 0 | xx | xx | xx | 135 |
| 10 | 65 | 170 | 0 | 0 | 0 | xx | xx | xx | 196 |
| 100 | 6 | 20 | 0 | 0 | 0 | 98 | 182 | 20 | 14 |
| 100 | 9 | 16 | 0 | 0 | 0 | 72 | 171 | 16 | 18 |
| Reduction | xx | xx | 99% | 99% | 99% | xx | xx | 91% | 91% |
| CONCLUSION | na | na | Pass | Pass | Pass | na | na | Pass | Pass |

Findings:

Samples were treated at 0.25% AND 0.5% on weight of goods (OWG) showed more than 99% efficacy initially and more than 91% after 50 washes. Samples showed excellent antimicrobial efficacy before and after washing 50 times .

Antimicrobial Efficacy of Test#: 072011-6
-MILITARY UNDERWEAR
(polyamide 95%; elastane 5%)

| Sample ID | 072011-6 | 072011-6 |
|----------------------------|--|--|
| Customer | "BRAND" Military Underwear | "BRAND" Military Underwear |
| Specifications | 95% Polyamide, 5% Elastane | 95% Polyamide, 5% Elastane |
| Comments and/or Conditions | Untreated. Chemicals Used: Some Finish Solution | Untreated. Chemicals Used: Some Finish Solution |
| Contact Results | Effective Antimicrobial Action Reduction 98% in 60 Minutes | Effective Antimicrobial Action Reduction 98% in 60 Minutes |
| Result After Washes | Effective Antimicrobial Action | Effective Antimicrobial 100% After 10 Washes |
| | Initial Treatment | 10 Washes |
| 0 Time | 95% Polyamide, 5% Elastane | 95% Polyamide, 5% Elastane |
| Dilution Factor | T4 | T3 |
| 1 | xx | xx |
| 1 | xx | xx |
| 10 | xx | xx |
| 10 | xx | xx |
| 100 | 102 | 98 |
| 100 | 97 | 69 |
| 60 Minute | | 24 hours |
| Dilution Factor | T4 | T1 |
| 1 | xx | xx |
| 1 | xx | xx |
| 10 | 55 | 0 |
| 10 | 31 | 0 |
| 100 | 3 | 0 |
| 100 | 2 | 0 |
| Reduction | 98% | >99% |
| CONCLUSION | Pass | Pass |

Findings:

Sample 6 with a Silicon Softener was treated at 0.5% on weight of goods (OWG) showed >99%, antimicrobial efficacy after 30 washes. Further testing showed excellent antimicrobial efficacy before and after 50 washes.

Antimicrobial Efficacy of Test#:102011-22
-FUSHSIA PATTERN PRINTED LYRCA AND NYLON JACKET(polyamide 85%; elastane 15%)

| Sample ID | 102011 - 22 | 102011 - 22 |
|----------------------------|---|---|
| Specifications | FUCHSIA PRINTED, LYCRA AND NYLON | FUCHSIA PRINTED, LYCRA AND NYLON |
| Comments and/or Conditions | WITHOUT FINISHING AND WITHOUT THERMOSITTING OR THERMOFIXING | WITHOUT FINISHING AND WITHOUT THERMOSITTING OR THERMOFIXING |
| Contact Results | | 96% AT 0.5% OWG |
| Result After Washes | | AFTER 20 WASHES |
| | | PASS |
| 0 Time | | 10% |
| Dilution Factor | Inoculum Only | T1 |
| 1 | xx | xx |
| 1 | xx | xx |
| 10 | xx | xx |
| 10 | xx | xx |
| 100 | 50 | 50 |
| 100 | 55 | 60 |
| 60 Minute | | 24 hours |
| Dilution Factor | Inoculum Only | T1 |
| 1 | xx | 239 |
| 1 | xx | 179 |
| 10 | xx | 21 |
| 10 | xx | 17 |
| 100 | 64 | 4 |
| 100 | 60 | 1 |
| Reduction | | 96% |
| CONCLUSION | | Pass |

Findings:

Samples showed excellent anti-microbial efficacy before and after washing. Sample 22 was treated at 0.5% on weight of goods (OWG) showed 94% after 20 washes.

Antimicrobial Efficacy of Test#: 112011-47
-MILITARY UNIFORM
(cotton 60%; polyester 40%)

| 102012 - 48.2 | 102012 - 48.2 | 102012 - 48.1 |
|--|--|---------------------------|
| "BRAND" Military Uniform | "BRAND" Military Uniform | "BRAND" Military Uniform |
| 60% Cotton, 40% Polyester | 60% Cotton, 40% Polyester | 60% Cotton, 40% Polyester |
| DETERMINE OPTIMAL LEVEL OF (2915 - 1916141125) FOR ANTIMICROBIAL EFFECTIVENESS AFTER TREATMENT AND RESIDUAL EFFECTIVENESS AFTER 20 WASHES. | DETERMINE OPTIMAL LEVEL OF (2915 - 1916141125) FOR ANTIMICROBIAL EFFECTIVENESS AFTER TREATMENT AND RESIDUAL EFFECTIVENESS AFTER 20 WASHES. | AFTER 50 WASHES |
| 5% | 10% | 10% |
| T2 (0.5% OWG) | T1 | T1 |
| xx | xx | xx |
| 77 | 57 | 74 |
| 72 | 69 | 79 |
| 60 Minutes | | |
| T1 | T1 | T1 |
| xx | 7 | 23 |
| xx | 6 | 16 |
| xx | 0 | 3 |
| xx | 0 | 3 |
| 61 | 0 | 0 |
| 58 | 0 | 0 |
| 20% | >99% | >99% |

Findings:

The samples washed 50 times at 0.5% OWG showed excellent antimicrobial efficacy of >99%

Conclusion

Based on the results from the experiments presented above, when *Microsure Antimicrobial Laundry Solution* was applied to all test samples, there was an obvious benefit. In each study it was clear that even after repeated commercial washes there was persistent efficacy that lasted up to 75 commercial washes for some of the tested garments. These results help solidify just how effective and powerful the newly modified antimicrobial surface becomes after application of the product. By using *Microsure Antimicrobial Laundry Solution* when washing textiles there is a significant decreased risk for bacterial attachment, therefore this product has proven to work effectively against harmful pathogens for a long period of time and will protect individuals from harmful microbes.