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 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 an 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 amount 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 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 (2915 - 1916141125) FOR ANTIMICROBIAL EFFECTIVENESS AFTER TREATMENT AND RESIDUAL EFFECTIVENESS AFTER 20 WASHES.		AFTER 50 WASHES
5%	10%	5%
T1 (0.5% OWG)	T3 (1.0% OWG)	T1
xx	xx	xx
xx	xx	xx
xx	xx	xx
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 al 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	"BRAND" Textile	"BRAND" Textile	"BRAND" Textile	"BRAND" Textile	"BRAND" Textile	"BRAND" Textile	"BRAND" Textile	"BRAND" Textile
Specifications	White Bath Towel	White Bath Towel	White Bath Towel	White Bath Towel	White Bath Towel	White Bath Towel	White Bath Towel	White Bath Towel	White Bath Towel
Comment/ Conditions	Hydrophilic Silicone Finishing	Hydrophilic Silicone Finishing	Hydrophilic Silicone Finishing	Hydrophilic Silicone Finishing	Hydrophilic Silicone Finishing	Hydrophilic Silicone Finishing	Hydrophilic Silicone Finishing	Hydrophilic Silicone Finishing	Hydrophilic 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	xx	xx	xx	xx	xx	xx	xx	xx
1.00	xx	xx	xx	xx	xx	xx	xx	xx	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	xx	xx	xx	xx	xx	xx	xx	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
Costumer	"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. Futher 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
xx	xx	xx
xx	xx	xx
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.