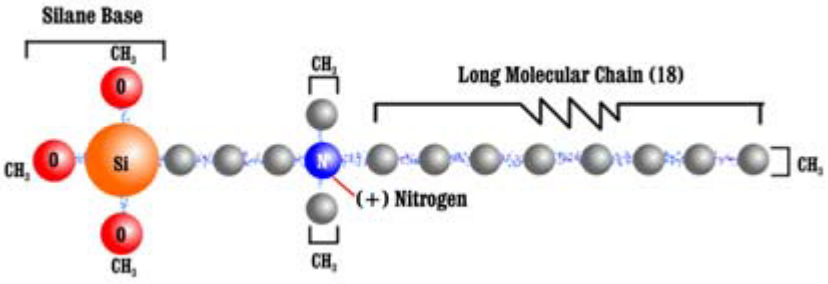
ANTIMICROBIAL SYSTEM

MicroArmor's AntiMicrobial System Is Comprised Of Advanced Technology Products That Work Synergistically To Eliminate And Inhibit The Growth Of A Broad Spectrum Of Microrganisms. Combined With Good Cleaning Practices and Good Hygiene They Protect Against And Reduce Exposure To Microrganisms That Can Cause Illness. The system is designed to achieve the optimum balance between performance and cost. Included within the system are MicroArmor's Cationic Surface Coating, RTU Cleaner / Disinfectant, Cationic Fabric Protectant and Skin Sanitizers and Antibacterial Soap.

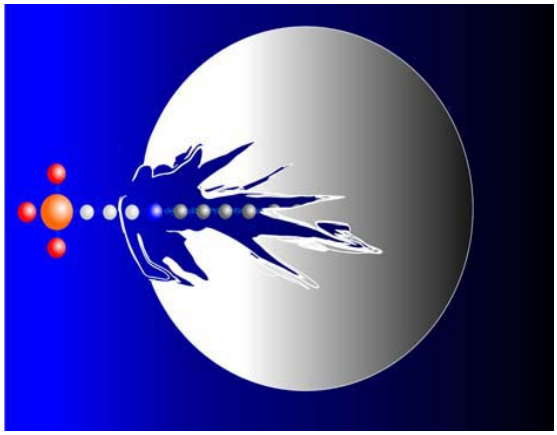
Cationic Surface Coating

An Organofunctional Silane Antimicrobial Technology

- MicroArmor's silane-quat (Si-Quat) based antimicrobial is a molecularly-bonded unconventional technology.
- The bound unconventional antimicrobial technology, an organofunctional silane, has a mode of action that results from the coating technology killing microorganisms as they contact the surface.
- Effective levels of this technology do not leach or diminish over time. The technology actually polymerizes with the substrate making the surface antimicrobial.
- Durability to wear and laundering with broad-spectrum antimicrobial activity have been demonstrated.
- When applied to any surface or substrate, MicroArmor's Antimicrobial Coating creates a durable, positively charged molecular bond around the surface that will not wear off or be absorbed by other organisms.



Once treated, the negatively charged microbes are attracted to the positively charged antimicrobial in the MicroArmor Antimicrobial system. The antimicrobial coating functions like a layer of electrically charged molecular swords piercing the approaching cell.



- As the microbe is further drawn onto the antimicrobial, it is electrocuted. This interaction is mechanical and physical, not chemical. Therefore, there is no depletion of the coating or its mode of action as a result of killing the microbe. The active layer remains intact, efficacious and ready for the next cell that approaches, 24/7/365.

Safety Profile

The ability of the Si-Quat, when properly applied, to chemically bond to the textile substrate and still provide for the broad-spectrum control of microorganisms, makes it well suited to the safety challenges encountered in the full range of applications used in a variety of industries and applications.

The following studies have been conducted with the Si-Quat: (a) acute oral, (b) acute ocular, (c) acute and subacute dermal, (d) acute vapor inhalation, (e) primary skin sensitization and irritation, (f) sub-acute vaginal irritation, (g) fourday static fish toxicity, (h) teratogenic evaluation, (i) sub-acute human wear test (socks), (j) human repeated insult patch test, (k) invitro Ames Microbial Assay with and without metabolic activation, (l) in-vitro mammalian cell transformation in the presence and absence of exogenous metabolic activation, (m) in-vitro Host- Mediated Assay and (n) a percutaneous absorption study.

No adverse effects are notable regarding treated substrates. Years of clinical use with no untoward effects also support the suitability of the coating for its intended use.

Case Study - The Arthur G. James Cancer Center Hospital and Research Institute

The study building is a 12-story comprehensive cancer center and research institute located in Columbus, Ohio. Just prior to its opening in January, 1990, a ruptured water pipe on the 12th floor flooded the building with an estimated 500,000 gallons of water.Large numbers of fungi and bacteria were retrieved from the air in all areas of the hospital. Large numbers of water-associated bacteria, such as Acinetobacter sp., as well as fungi were retrieved from carpeting.

All accessible interior surfaces (including carpeting, ceilings, walls, above ceiling space, furnishings, elevator shafts, mechanical and electrical chases) were treated with the Si-Quat antimicrobial in accordance with the manufacturer's application specifications.

Each of the 24 Bone Marrow Transplant patient rooms was negative for microorganisms during all of the post-treatment samplings. The facility is presently free of odor and has a new appearance unaffected by the extensive application of a surface antimicrobial.

No fungal nosocomial infections were recorded in this facility during the 30-month study and a post study check after five years.

All renovations or reconstruction in the facility were strictly controlled and all newly added or modified surfaces were treated with Si-Quat antimicrobial for five years after the initial treatment.

Study - Nonwoven Surgical Drapes

A considerable body of microbiological efficacy data was generated to support the effectiveness of the nonwoven surgical drape through a variety of microbiological tools.

These included: in-vitro tests, Scanning Electron Microscopy (SEM) work, and clinical evaluations. The purpose of these tests was to support claims relating to the reduction of microbial dose on the drape in the vicinity of the wound.

The surgical drape fabric was found to kill the bacteria commonly associated with surgical wound infections and takes an active role in maintaining an aseptic field at the wound site. The antimicrobial coating serves to isolate the wound from bacterial transfer from the drape surface.

The antimicrobial component of this fabric was chemically bonded, safe for use in surgery, and did not lose its effectiveness when sterilized, stored, or handled during the manufacturing procedure or in surgery

Wound Care Silk Dressings

The Department of Pediatrics at the University of Bologna evaluated the effectiveness of a special silk fabric (MICROAIR DermaSilk treated with Si-Quat technolgy) in the treatment of young children affected by AD with acute lesions at the time of examination.

Using the SCORAD index, a significant decrease in AD severity was noted with the treated dressings (mean SCORAD decrease from 43 to 30: P= 0,003).

This allowed for the conclusion that such treated clothes (dressings) should be useful in the management of AD in children.

Hospital Blankets

Participation with Spartan Mills and the Virkler Company in studying blankets that were treated with the technology and blankets that were untreated. In any environment, blankets can become a haven for bacteria.

Studies clearly show that blankets protected by the Si-Quat technology have a significantly lower bioburden and will present less of a risk in the patient environment.

These data generated by university, medical and industrial laboratories represent some of the most extensive microbiological work ever performed on antimicrobial treated substrates for use in the medical community. The control of the microorganisms is impressive and provides numerous benefits.

- Prevents blanket staining due to mold and mildew growth that occurs on damp blankets prior to laundering.
- Controls blanket deterioration due to microbial growth that occurs on blankets during storage.
- Controls odors caused by bacteria and fungus normally found in blankets.
- Provides 3 times more protection from bacteria and fungus than an untreated blanket.

Summary

The health care industry is challenged with providing the best possible care for their patients and a safe environment for health care workers. Microorganisms are the most prevalent and potent pollutants in the indoor environment and their role as causers and aggravators of disease conditions are well documented. The proven technology with the properties appropriate for use at all stages of a facilities “life” is; MicroArmor’s Si-Quat based, Cationic Surface Coating Antimicrobial System.

References

Krueger, James W., Reducing Microbial Contamination in Hospital Blankets. 2003

White, W.C., and J.M. Olderman. Antimicrobial Techniques for Medical Nonwovens: A Case Study. Proc.INDA. 1982.

Ricci, G., Patrizi, A., Bendandi, B., Menna, G., Varotti, E., and M. Masi. Clinical Effectiveness of a Silk Fabric in the Treatment of Atopic Dermatitis. Journal of Dermatology 2004; 150: 127-131.

Kemper, R. A., W. C. White, and R. L. Gettings. Sustained Aeromicrobiological Reductions Utilizing Silane- Modified Quaternary Amines Applied to Carpeting: Preliminary Data From an Observational Study of Commercial Buildings. Dev. Ind. Microbial. 31:237-244. (J. Ind. Microbial., Suppl. No. 5), 1990.

Ayers, L., B. Fox, C. Jacobson, C. Smith, R. Kemper, and C. White. Ohio State University Case Study - Aeromicrobial Control in an Extensively Damaged Hospital Using a Long Lasting, Surface Active, Silane Antimicrobial. 18th Annu. Educ. & Intl. Conf. of Assoc. Practitioners in Infection Control. May 7, 1991

MicroArmor RTU Cleaner / Disinfectant

DESCRIPTION

One-step disinfectant and cleaner that cuts through bios-limes, dirt and grime. EPA Registered Disinfectant, Cleaner, Biocide, Virucide, Fungicide, Mildewstat and Deodorizer.

FEATURES

- o Proprietary blend of the high quality, plant derived, quaternary compounds and cleaning agents.
- o High Bio-renewable index as it contains materials of vegetable origin that can be replenished in the environment in a relatively short period of time.
- o One step no rinse disinfectant cleaner that disinfects, cleans, and deodorizes in one labor saving step
- o Neutral pH and phosphate free formulation.
- o Eliminates odors.
- o Eliminates Bacteria, Fungi and Viruses that would ordinarily survive traditional cleaning techniques.
- o This product requires no rinsing and will not leave any grit or soap residue.

MicroArmor RTU Cleaner Disinfectant
Efficacy Testing

BACTERIALCIDAL

Organism	Carrier Population	Sample	# Carriers	# Positive
Pseudomonas aeruginosa ATCC #15442	2.3 X 106CFU/Carrier	A	60	0/60
	1.7 X 106CFU/Carrier	B	60	0/60
	1.3 X 106CFU/Carrier	C	60	1/60
Salmonella enterica ATCC #10708	1.1 X 105CFU/Carrier	A	60	0/60
	1.5 X 106CFU/Carrier	B	60	0/60
	2.1 X 106CFU/Carrier	C	60	0/60

Organism	Carrier Population	Sample	# Carriers	# Positive
ATCC #6538	1.4 X 106CFU/Carrier	B	60	0/60
	4.7 X 105CFU/Carrier	C	60	0/60

This product is bactericidal according to the AOAC Use Dilution Test method on hard inanimate surfaces modified in the presence of 5% organic serum (850 ppm active)

Burkholderia cepacia	3.5 X 106CFU/Carrier	A	10	0/10
ATCC 25416		B	10	0/10
Campylobacter jejuni	2.9 X 105 CFU/Carrier	A	10	0/10
ATCC 29428		B	10	0/10
Corynebacterium	1.8 X 105 CFU/Carrier	A	10	0/10
ammoniagenes		B	10	0/10
ATCC 6871				
Enterobacter aerogenes	4.1 X 106 CFU/Carrier	A	10	0/10
ATCC 13048		B	10	0/10
Enterobacter cloacae	3.9 X 105 CFU/Carrier	A	10	0/10
Clinical Isolate		B	10	0/10
Enterococcus faecalis	9.4 X 104 CFU/Carrier	A	10	0/10
ATCC 19433		B	10	0/10
Enterococcus faecium	4.5 X 105 CFU/Carrier	A	10	0/10
Vancomycin Resistant		B	10	0/10
(VRE)				
Escherichia coli	3.2 X 105 CFU/Carrier	A	10	0/10
ATCC 11229		B	10	0/10
Escherichia coli Antibiotic	3.9 X 105 CFU/Carrier	A	20	0/20
Resistant Clinical Isolate		B	20	0/20
Escherichia coli 0157:H7	1.1 X 104 CFU/Carrier	A	20	0/20
ATCC 35150		B	20	0/20
Klebsiella pneumoniae	9.9 X 104 CFU/Carrier	A	10	0/10
ATCC 4352		B	10	0/10
Klebsiella pneumoniae	2.7 X 105 CFU/Carrier	A	10	0/10
Antibiotic Resistant		B	10	0/10
Clinical Isolate				
Legionella pneumophila	8.2 X 107 CFU/Carrier	A	10	0/10
ATCC 33153		B	10	0/10

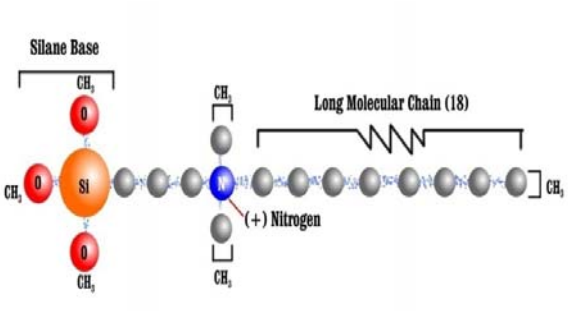
Listeria monocytogenes ATCC 984	1.85 X 105 CFU/Carrier	A B	10 10	0/10 0/10
Proteus mirabilis Clinical Isolate	1.9 X 106 CFU/Carrier	A B	20 20	0/20 0/20
Proteus vulgaris ATCC 33420	4.55 X 104 CFU/Carrier	A B	20 20	0/20 0/20
Pseudomonas aeruginosa Clinical Isolate	1.2 X 106 CFU/Carrier	A B	10 10	0/10 0/10
Salmonella typhi ATCC 6539	5.1 X 105 CFU/Carrier	A B	10 10	0/10 0/10
Serratia marcescens ATCC 43861	1.5 X 105 CFU/Carrier	A B	10 10	0/10 0/10
Shigella dysenteriae ATCC 9361	5.45 X 104 CFU/Carrier	A B	10 10	0/10 0/10
Shigella flexneri ATCC 12022	4.85 X 104 CFU/Carrier	A B	20 20	0/20 0/20
Shigella sonnei ATCC 9290	2.75 X 104 CFU/Carrier	A B	20 20	0/20 0/20
Staphylococcus aureus (Methicillin Resistant) (MRSA) ATCC 33591	1.45 X 105 CFU/Carrier	A B	10 10	0/10 0/10
Staphylococcus epidermidis Antibiotic Resistant Clinical Isolate	4.2 X 105 CFU/Carrier	A B	10 10	0/10 0/10
Streptococcus pyogenes ATCC 19615	3.35 X 106 CFU/Carrier	A B	10 10	0/10 0/10
Vibrio cholera ATCC 11623	9.3 X 106 CFU/Carrier	A B	10 10	0/10 0/10

Testing is performed per the AOAC UDT/GST method. Ten carriers are required on 2 separate lots against each supplemental organism. Killing of 10 out of 10 carriers is required (total carriers = 20).

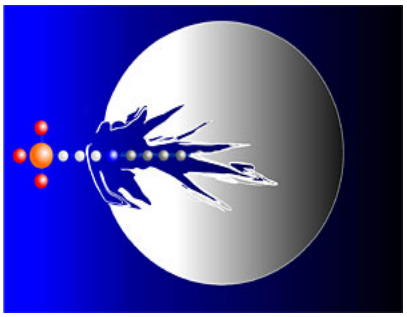
Cationic Fabric Protectant

Advanced Biostatic Technology - MicroArmor's Fabric Protectant is an EPA registered, environmentally friendly, water based, non-leaching material Coating. This coating technology actually polymerizes with the fabric making it antimicrobial.

- Provides a physical mode-of-action, swords that attract, puncture and then electrocute the microbes.
- No chemical leaching.
- Reduces or eliminates use of harsh chemical disinfectants.



The cell membrane of the microbial is attracted to the treated surface and then punctured by the long carbon/hydrogen molecular chain. The electrostatically charged particles in the coating further destroy the microorganism by electrocution.



- Provides 24/7 Anti-Microbial Protection
- Inhibits growth of microbes.
- Protects for at least 30 washes
- Eliminates odors caused by bacteria
- Invisible, colorless formula will not alter appearance, feel or characteristics of fabric
- Adds wickability and softness to fabrics

- Extends life of fabric

- Inhibits the growth of bacteria which can cause odors and deterioration.
- Same technology used by NFL, NBA, MLB, Collegiate and High School teams.

Fabric & Surface Protectant
Representative Efficacy Test

Bacteria

Methicillin resistant staphylococcus aureus
Micrococcus sp.
Staphylococcus epidermidis(1)
Enterobacter agglomerans(1)
Acinetobacter calcoaceticus(1)
Staphylococcus aureus (pigmented)(1)
Staphulococcus aureus (non-pigmented)(1)
Klebsiella pneumoniae ATCC 4352
Mycobacterium smegmatis
Mycobacterium tuberculosis
Brucella cania
Brucella abortus
Brucella suis
Streptococcus mutans
Bacillus subtilis
Bacillus cereus

Pseudomonas aeruginosa
Enterococcus faecium
Pseudomonas aeruginosa PDR-10
Streptococcus faecalis
Escherichia coli ATCC 23266
Escherichia coli(1)
Proteus mirabilis
Proteus mirabilis(1)
Citrobacter diversus(1)
Salmonella typhosa
Salmonella choleraesuis
Corynebacterium bovis
Clostridium perfringens
Haemophilus influenzae
Haemophilus suis
Lactobacillus casei
Leuconostoc lactis
Listeria monocytogenes
Propionibacterium acnes
Proteus vulgaris
Pseudomonas cepacia
Pseudomonas fluorescens
Xanthomonas campestris

Fungus

Tinea gladiatorum
Aspergillus niger.
Aspergillus fumigatus
Aspergillus versicolor
Aspergillus flavus
Aspergillus terreus
Penicillium chrysogenum
Penicillium albicans
Penicillium citrinum
Penicillium elegans
Penicillium funiculosum
Penicillium humicola
Penicillium notatum
Penicillium variabile
Mucor sp
Tricophyton mentagrophytes
Tricophyton interdigitalie
Trichoderma flavus
Chaetomium globusum
Rhizopus nigricans
Cladosporium herbarum
Aerobasidium pullulans
Fusarium nigrum
Fusarium solani
Gliocladium roseum
Oospora lactis
Stachybotrys atra

Algae

Oscillatoria borneti LB143
Anabaena cylindrica B-1446-1C
Selenastrum gracile
Pleurococcus sp. LB11
Schenedesmus quadricauda
Gonium sp. LB 9c
B-325 Volvox sp. LB 9
Chlorella vulgarus

Yeast

Saccharomyces cerevisiae
Candida albicans

1. Clinical isolates

Study - Nonwoven Surgical Drapes

A considerable body of microbiological efficacy data was generated to support the effectiveness of the nonwoven surgical drape through a variety of microbiological tools.

These included: in-vitro tests, Scanning Electron Microscopy (SEM) work, and clinical evaluations. The purpose of these tests was to support claims relating to the reduction of microbial dose on the drape in the vicinity of the wound.

The surgical drape fabric was found to kill the bacteria commonly associated with surgical wound infections and takes an active role in maintaining an aseptic field at the wound site. The antimicrobial coating serves to isolate the wound from bacterial transfer from the drape surface.

The antimicrobial component of this fabric was chemically bonded, safe for use in surgery, and did not lose its effectiveness when sterilized, stored, or handled during the manufacturing procedure or in surgery

White, W.C., and J.M. Olderman. Antimicrobial Techniques for Medical Nonwovens: A Case Study. Proc.INDA. 1982.

Hospital Blankets

Participation with Spartan Mills and the Virkler Company in studying blankets that were treated with the technology and blankets that were untreated. In any environment, blankets can become a haven for bacteria.

Studies clearly show that blankets protected by the Si-Quat technology have a significantly lower bioburden and will present less of a risk in the patient environment.

These data generated by university, medical and industrial laboratories represent some of the most extensive microbiological work ever performed on antimicrobial treated substrates for use in the medical community. The control of the microorganisms is impressive and provides numerous benefits.

- Prevents blanket staining due to mold and mildew growth that occurs on damp blankets prior to laundering.
- Controls blanket deterioration due to microbial growth that occurs on blankets during storage.
- Controls odors caused by bacteria and fungus normally found in blankets.
- Provides 3 times more protection from bacteria and fungus than an untreated blanket.

Krueger, James W., Reducing Microbial Contamination in Hospital Blankets. 2003

MICROARMOR SKIN SANITIZER & ANTIBACTERIAL FOAMING SOAP

DESCRIPTION

Plant derived hand and skin sanitizer spray, foam, wipes and antibacterial foaming soap that kills up to 99.9999% of germs. Along with frequent hand washing these products help protect against and reduce bacteria, viruses and fungi that cause disease.

FEATURES

- Non-alcohol formula will not dry skin and remove natural oils.
- Unique formulation that is both Antibacterial and Antimicrobial.
- Improves skin condition with repeated use.
- Unlike alcohol based products, MicroArmor remains effective for 2-4 hours.

- Effective against MRSA and VRE and other germs that alcohol based products are not.
- Unlike alcohol based products is non-flammable, non-intoxicating and safe for kids.
- More effective and lower in cost than competitive products.
- Various sizes available in foaming, wipes and sprays.

Many popular hand sanitizers and antimicrobial soaps use harsh ethyl alcohol, harsh foaming agents, synthetic gels, preservatives and banned active ingredients such as Triclosan. These ingredients are harmful to children and not easily broken down in the environment, harming wildlife and damaging the ecosystem.

All ingredients used in MicroArmor Skin Sanitizer and Antibacterial Soap are natural and plant derived - from soy, palm, coconut and corn. They have a biorenewable index of 75 as they contain materials of vegetable origin that can be replenished in the environment in a relatively short period of time. Plant oils and oleochemicals derived from them represent such alternative sources, which can deliver a substantial part of what is needed to replace petroleum based raw materials. Plant derived raw materials, such as those used in the making of MicroArmor products are directly renewable by the photosynthetic reduction of carbon dioxide from the atmosphere.

Efficacy Testing

MicroArmor's Hand Sanitizer and Antibacterial Soap formulas are very efficient at reducing a broad range of pathogenic bacteria in as little as 15 seconds as the Chlorine Equivalency and Time Kill Data below illustrate. MicroArmor is very effective at reducing bacteria on the skin, yet very gentle on the skin and eyes.

Time Kill Study

This study is designed to examine the rate of kill of a test substance after inoculation with a test organism. Results are expressed in percent reduction and log reduction of the test organism. Exposure time 15 Seconds

Organism	Test Population Control (CFU/ml)	Number of Survivors (CFU/ml)	% Reduction	Log Reduction
Campylobacter jejuni ATCC 29428	1.02×10^7	$<1 \times 10^2$	>99.999	>5.00 Log10
Candida albicans ATCC 10231	1.60×10^5	6.0×10^3	96.3	1.42 Log10
Clostridium difficile ATCC 9689	3.40×10^6	<2	>99.9999	>6.20 Log10
Enterococcus faecalis Vancomycin Resistant (VRE) ATCC 51575	1.12×10^6	3.2×10^1	99.99	4.54 Log10
Escherichia coli ATCC 11229	3.80×10^6	4	99.999	6.00 Log10
Escherichia coli O157:H7 ATCC 35150	1.26×10^6	<2	>99.999	>5.80 Log10

Organism	Test Population Control (CFU/ml)	Number of Survivors (CFU/ml)	% Reduction	Log Reduction
Klebsiella pneumoniae ATCC 4352	1.10×10^6	2	99.999	5.70 Log10
Listeria monocytogenes ATCC 19117	4.7×10^6	1.9×10^3	99.9	3.39 Log10
Pseudomonas aeruginosa ATCC 15442	3.5×10^6	<2	99.9999	>6.20 Log10
Salmonella choleraesuis serotype enteritidis ATCC 4931	6.8×10^5	2	>99.999	5.50 Log10
Salmonella choleraesuis serotype paratyphi ATCC 8759	5.6×10^5	<2	>99.999	>5.50 Log10
Salmonella choleraesuis serotype pullorum ATCC 19945	8.9×10^5	<2	>99.999	>5.70 Log10
Salmonella choleraesuis serotype typhimurium ATCC 23564	7.7×10^5	6	>99.999	>5.10 Log10
Salmonella typhi ATCC 6539	1.27×10^6	2	99.999	5.80 Log10
Shigella dysenteriae ATCC 13313	1.3×10^6	<2	>99.999	>5.80 Log10
Shigella flexneri ATCC 12022	1.39×10^6	2.8×10^1	99.99	4.69 Log10
Shigella sonnei ATCC 25931	2.43×10^7	2.0×10^1	99.9999	6.09 Log10
Staphylococcus aureus ATCC 6538	6.7×10^6	<2	>99.9999	>6.53 Log10
Staphylococcus aureus Methicillin Resistant (MRSA) ATCC 33592	1.23×10^7	3.8×10^3	>99.9	3.51 Log10
Staphylococcus epidermidis ATCC 12228	7.2×10^5	<2	99.999	5.56 Log10
Streptococcus pneumonia ATCC 6305	6.4×10^5	<2	>99.999	>5.51 Log10
Streptococcus pyogenes ATCC 19615	1.77×10^6	<2	>99.999	>5.90 Log10
Vibrio cholera ATCC 11623	4.7×10^5	<2	>99.999	>5.40 Log10
Xanthomonas axonopodis (Citrus Canker) ATCC 49118	1.28×10^6	3.6×10^1	>99.99	4.55 Log10

Yersinia enterocolitica ATCC 23715	2.23 X 10^6	3.8 X 10^1	99.99	4.77 Log10

Efficacy Result

MicroArmor Hand Sanitizer demonstrated an available chlorine equivalent to greater than the 200 ppm NaOCl standard control when tested against *Staphylococcus aureus* and *Salmonella typhi*.

Testing Protocols

Chlorine Equivalency Test - *Official Methods of Analysis of the AOAC, Sixteenth Edition, 1995. Chapter 6 – Disinfectants, 955.16 Chlorine (Available) in Disinfectants, Germicidal Equivalent Concentration.*
The object of this test is to determine the available chlorine germicidal equivalent concentration of the product as compared to 200, 100 and 50 ppm available chlorine in the NaOCl standard controls.

Application of the HPLC method for benzalkonium chloride determination in aerosol preparations, J. Dudkiewicz-Wilczynska, J. Tautt, I. Roman, J. Pharm. Biomed. Anal. 34 (2004) 909-920.
[Available online at www.sciencedirect.com]

** Independent third party testing was performed by ATS Labs, Eagan, MN **