



LABORATORY TESTING REPORT

The following report details the efficacy of CASPR Medik™ to continuously reduce pathogens on surfaces in a controlled, independent laboratory setting.



REPORTING COMPLETED BY:



MicroChem Laboratory adheres to ASTM E1153 testing methods and meets the following requirements in order to be scientifically defensible:

- Ordinary consistency between replicates must be observed for the control carriers
- Positive/Growth controls must demonstrate growth of appropriate test microorganism
- Negative/Purity controls must demonstrate no growth of test microorganism

Results

The results show material reduction of bacteria, fungi, and viruses after the installation of Caspr Medik. The difference between the control samples and the samples exposed to CASPR shows a significant reduction of pathogens on surfaces independently of the pathogen tested. The following data highlights the percentages of reduction of microorganisms on surfaces, compared to a control which has not been exposed to CASPR.

Individual results on surfaces within the test room showed significant reductions ranging from 91% to over 99.998%. The continuous disinfection from low levels of H₂O₂ were found to exert a significant reduction of the microbial burden compared to the control microorganisms that were not exposed to CASPR.

Testing results indicate that CASPR materially reduces or eliminates microorganisms on surfaces in a controlled environment. Results showed Bacteria was reduced over 99.998%, Fungi was reduced over 95%, Methicillin Resistant Staphylococcus (MRSA) was reduced over 99.98%, Influenza A (H1N1) was reduced over 99.93%, and MS2 (virus) was reduced over 99.993%, on surfaces during the testing.

CASPR was very effective in eliminating hospital indigenous pathogens, including MRSA, upon contact on all surfaces.

Protocol and Procedures

The test microorganism is prepared, usually by growth in liquid culture medium or on an appropriate agar plate. The test culture may be supplemented with an artificial soil load, such as horse or fetal bovine serum, for one-step cleaner/sanitizer claims. Sterilized carriers are inoculated with a volume of the test culture. Inoculated slides are dried and only completely dried carriers are used in the test. Test carriers are treated with the test device and incubated for the predetermined contact time. Control carriers are harvested at appropriate intervals to accurately represent any reduction during the contact time. At the conclusion of the contact time, test and control carriers are chemically neutralized. Dilutions of the neutralized test substance are evaluated using appropriate growth media to determine the surviving microorganisms at the respective contact time. The effect of the test substance is compared to the effect of the control substance in order to determine microbial reductions.

Environmental Cleaning & Disinfecting Protocols

Despite heightened attention to improving and promoting environmental cleaning and disinfecting protocols (1), Healthcare Associated Infections (HAIs) remain a major complication of hospital care occurring at an estimated rate of nearly two-million annually in the US resulting in 99,000 hospital patient deaths (2) at a cost of between \$28 to \$45 billion (3). Increasing evidence points to environmental surfaces being a significant reservoir for microbes and that the levels of burden on a common surface have no correlation with the frequency of touching (4). Other studies measure the areas missed due to visually cleaning (5), the logistical complications with current no-touch methods (6), and the need for new technologies and interventions to achieve safe continuous environmental disinfection within the healthcare setting (7).

Meet CASPR

CASPR utilizes a revolutionary and doped hydrophilic photocatalytic coating, consisting of titanium dioxide with a proprietary combination of additional transition elements to enhance efficacy. Activated by multiple specific wavelengths of ultraviolet light, oxygen and humidity are extracted from the air to create a plasma of powerful hydroxyl oxidizers that target air and surface pathogens. These oxidizers, primarily consisting of H_2O_2 , (VOCs), and other environmental contaminants are not harmful to humans, pets and plants, and are completely safe for indoor use in occupied spaces. Two very important things to note is that the UV is just a wavelength power source; it is not what is disinfecting surfaces, and CASPR generates no ozone.

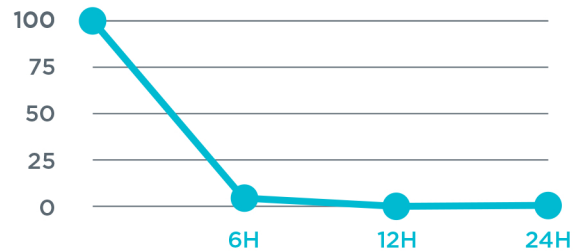
Methicillin Resistant Staphylococcus aureus (MRSA)



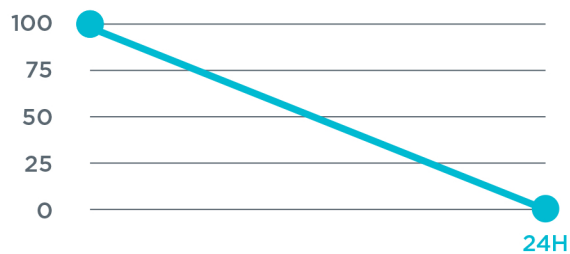
Enterococcus faecalis (VRE)



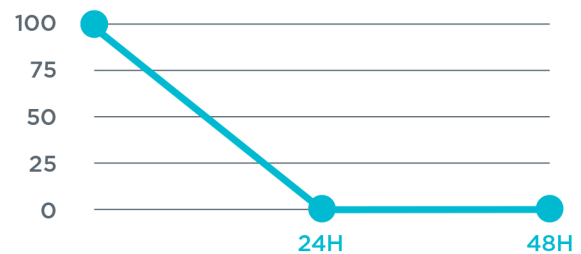
Pseudomonas aeruginosa



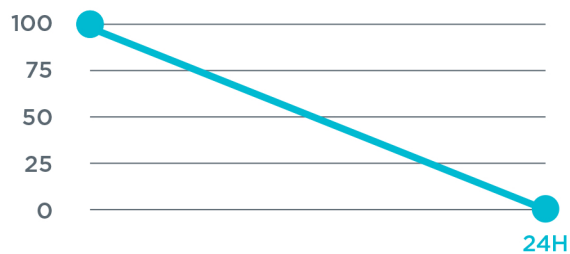
Feline Calicivirus



Trichophyton interdigitale



Influenza A (H1N1)

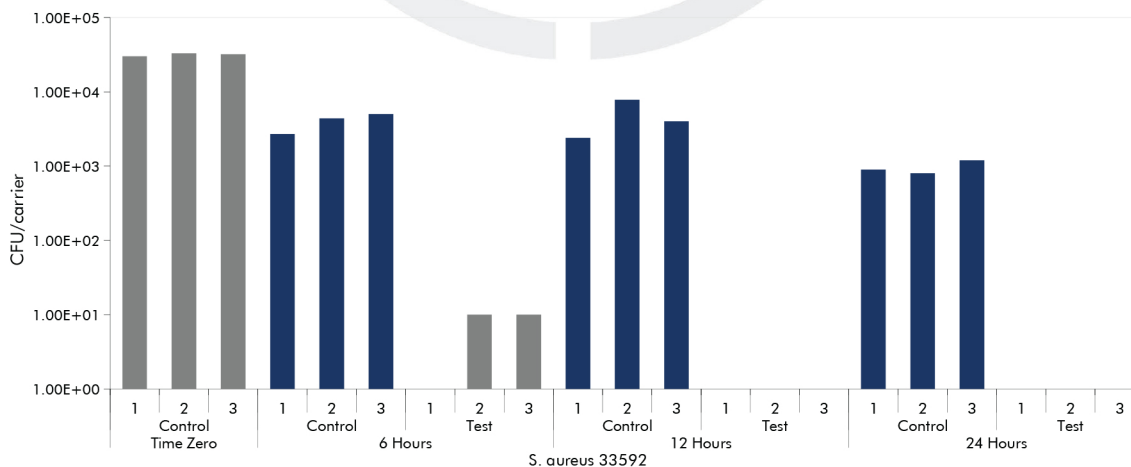


MS2 Bacteriophage (MS2)

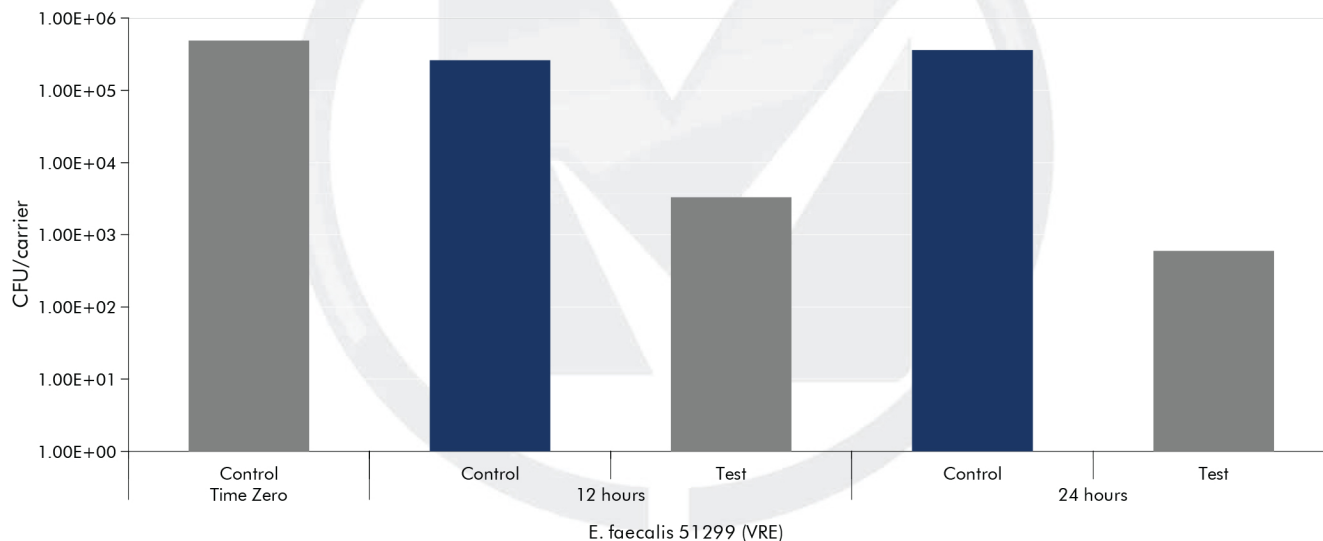


Test Microorganism	Contact Time	Run Type	Replicate	CFU/carrier	Average CFU/carrier	Average Percent Reduction vs. Parallel Control	Average Log ₁₀ Reduction vs. Parallel Control
<i>S. aureus</i> (MRSA) ATCC 33592	Time Zero	Control	1	3.00E+04	3.17E+04	N/A	
			2	3.30E+04			
			3	3.20E+04			
	6 Hours	Control	1	2.70E+03	4.03E+03	N/A	
			2	4.40E+03			
			3	5.00E+03			
		Test	1	<1.00E+01	<1.00E+01	>99.75%	>2.61
			2	1.00E+01			
			3	1.00E+01			
	12 Hours	Control	1	2.40E+03	4.73E+03	N/A	
			2	7.80E+03			
			3	4.00E+03			
		Test	1	<1.00E+00	<1.00E+00	>99.98	>3.68
			2	<1.00E+00			
			3	<1.00E+00			
	24 Hours	Control	1	9.00E+02	9.67E+02	N/A	
			2	8.00E+02			
			3	1.20E+03			
		Test	1	<1.00E+00	<1.00E+00	>99.90%	>2.99
			2	<1.00E+00			
			3	<1.00E+00			

Note: the limits of detection for the 6-hour contact time was 1.00E+01 CFU/carrier and for the 12 and 24-hour contact times was 1.00E+00 CFU/carrier. Values observed below the limit of detection are listed as <1.00E+01 and <1.00E+00 in the table and as zero in the graph.

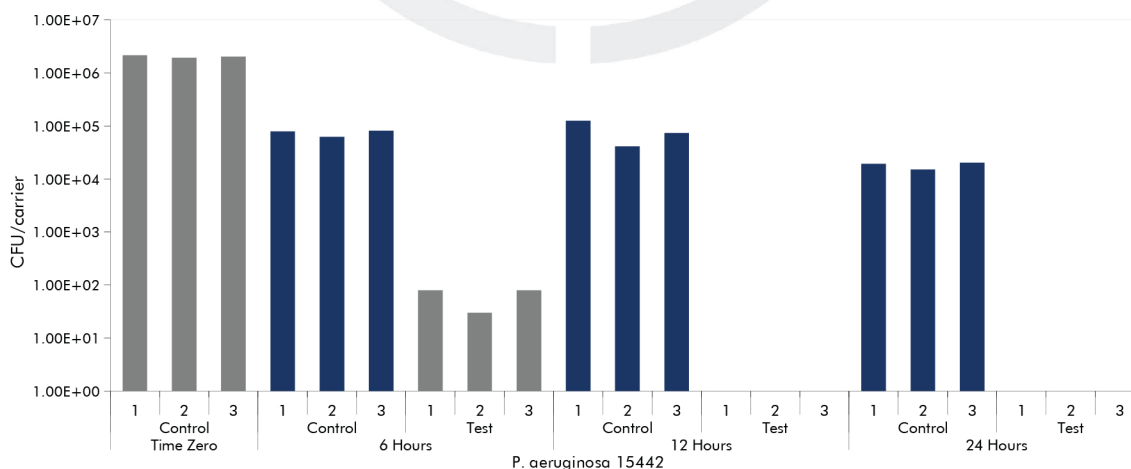


Test Microorganism	Contact Time	Run Type	CFU/carrier	Percent Reduction vs. Parallel Control	Log ₁₀ Reduction vs. Parallel Control
<i>E. faecalis</i> ATCC 51299 (VRE)	Time Zero	Control	4.90E+05	N/A	
	12 hours	Control	2.60E+05	N/A	
		Test	3.30E+03	98.73%	1.90
	24 hours	Control	3.60E+05	N/A	
		Test	6.00E+02	99.83%	2.78



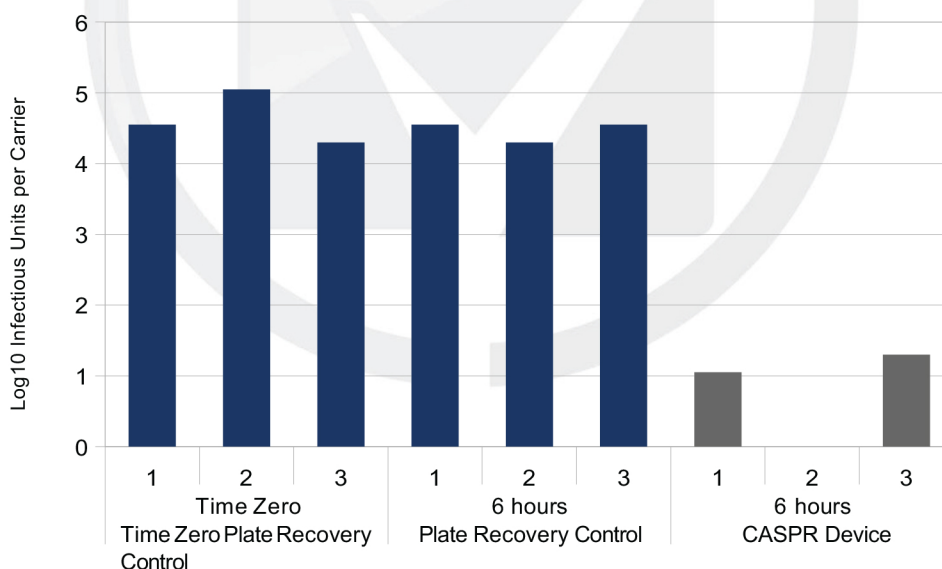
Test Microorganism	Contact Time	Run Type	Replicate	CFU/carrier	Average CFU/carrier	Average Percent Reduction vs. Parallel Control	Average Log ₁₀ Reduction vs. Parallel Control
<i>P. aeruginosa</i> ATCC 15442	Time Zero	Control	1	2.15E+06	2.04E+06	N/A	
			2	1.93E+06			
			3	2.03E+06			
	6 Hours	Control	1	7.90E+04	7.40E+04	N/A	
			2	6.20E+04			
			3	8.10E+04			
		Test	1	8.00E+01	6.33E+01	99.91%	3.07
			2	3.00E+01			
			3	8.00E+01			
	12 Hours	Control	1	1.25E+05	8.00E+04	N/A	
			2	4.10E+04			
			3	7.40E+04			
		Test	1	<1.00E+00	<1.00E+00	>99.998%	>4.90
			2	1.00E+00			
			3	<1.00E+00			
	24 Hours	Control	1	1.93E+04	1.82E+04	N/A	
			2	1.51E+04			
			3	2.03E+04			
		Test	1	<1.00E+00	<1.00E+00	>99.995%	>4.26
			2	<1.00E+00			
			3	<1.00E+00			

Note: the limit of detection for this study was 1.00E+00 CFU/carrier. Values observed below the limit of detection are listed as <1.00E+00 in the table and as zero in the graph



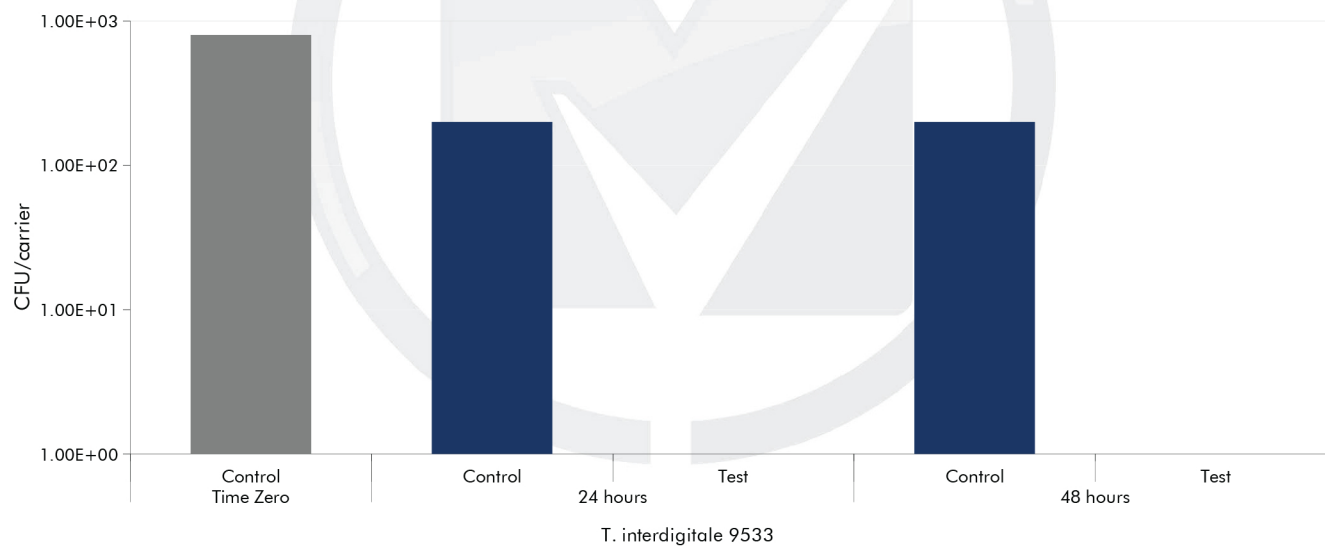
Tes t Microorganis m	Subs tance Des ignat ion	Cont act Time	Replicat e	Log I nfect iou s Unit s Per Carrier ₁₀	Average Log ₁₀ I nfect ious Unit s Per Carrier	Average Log ₁₀ Redu ct ion I nfect ious Unit s Per Carrier Compared t o Plat e Recovery Cont rol	Average Percent Redu ct ion I nfect ious Unit s Per Carrier Compared t o Plat e Recovery Cont rol
Feline Calicivirus (EPA-approved human norovirus surrogate), ATCC VR-782	Time Zero Plate Recovery Control	Time Zero	1	4.55	4.63	N/A	
			2	5.05			
			3	4.30			
	Plate Recovery Control	6 hours	1	4.55	4.47		
			2	4.30			
			3	4.55			
	CASPR Device	6 hours	1	1.05	≤1.05	≥3.42	≥99.96%
			2	≤0.80			
			3	1.30			

Results for Feline calicivirus, ATCC VR-782:

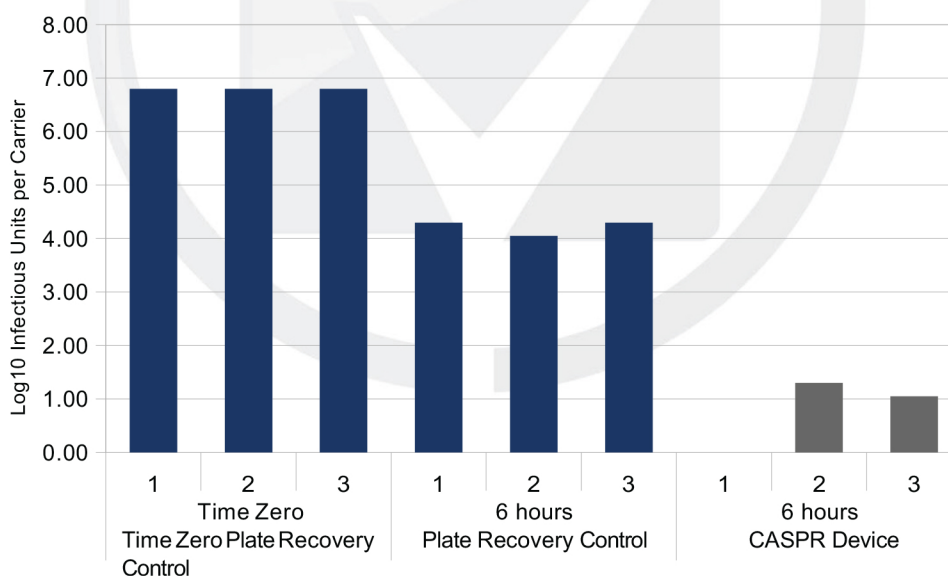


Test Microorganism	Contact Time	Run Type	CFU/carrier	Percent Reduction vs. Parallel Control	Log ₁₀ Reduction vs. Parallel Control
<i>T. interdigitale</i> ATCC 9533	Time Zero	Control	8.00E+02	N/A	
	24 hours	Control	2.00E+02	N/A	
		Test	<1.00E+01	>95.00%	>1.30
	48 hours	Control	2.00E+02	N/A	
		Test	<1.00E+01	>95.00%	>1.30

Note: the limit of detection for this study was 1.00E+01 CFU/carrier. Values observed below the limit of detection are listed at <1.00E+01 in the table and as zero in the graph.

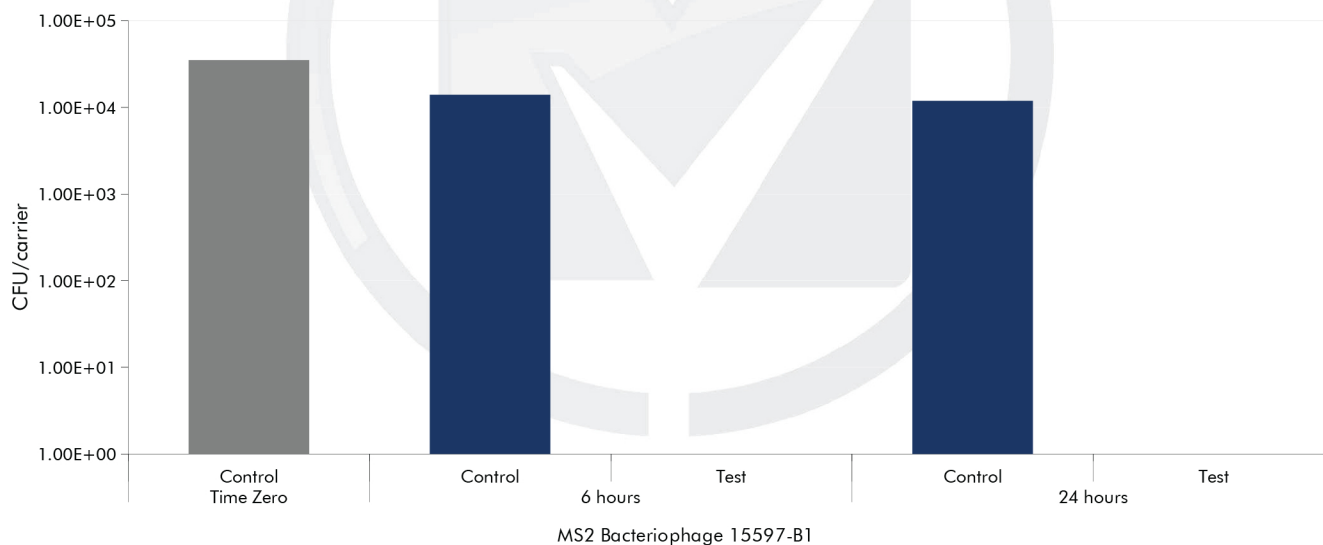


Tes t M icroorganis m	Subs t ance Des ignat ion	Cont act Time	Replicat e	Log I nfect iou s ¹⁰ Unit s Per Carrier	Average Log ₁₀ I nfect ious Unit s Per Carrier	Average Log ₁₀ Redu ct ion I nfect ious Unit s Per Carrier Compared t o Plat e Recovery Cont rol	Average Percent Redu ct ion I nfect ious Unit s Per Carrier Compared t o Plat e Recovery Cont rol
Influenza A (H1N1), ATCC VR-1469	Time Zero Plate Recovery Control	Time Zero	1	6.80	6.80	N/A	
			2	6.80			
			3	6.80			
	Plate Recovery Control	6 hours	1	4.30	4.22		
			2	4.05			
			3	4.30			
	CASPR Device	6 hours	1	≤0.80	≤1.05	≥3.17	≥99.93%
			2	1.30			
			3	1.05			



Test Microorganism	Contact Time	Run Type	CFU/carrier	Percent Reduction vs. Parallel Control	Log ₁₀ Reduction vs. Parallel Control
MS2 Bacteriophage ATCC 15597-B1	Time Zero	Control	3.50E+04	N/A	
	6 hours	Control	1.40E+04	N/A	
		Test	<1.00E+00	>99.993%	>4.15
	24 hours	Control	1.19E+04	N/A	
		Test	<1.00E+01	>99.92%	>3.08

Note: the limit of detection for the 6-hour contact time was 1.00E+00 CFU/carrier and for the 24-hour contact time was 1.00E+01 CFU/carrier. Values observed below the limit of detection are listed as <1.00E+00 or <1.00E+01 in the table and as zero in the graph.

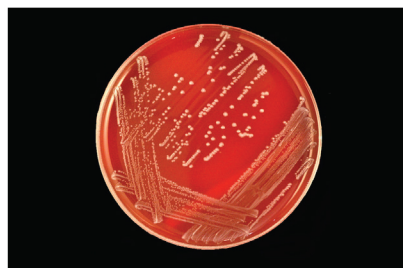


GLOSSARY AND PHOTOGRAPHY PROVIDED BY:



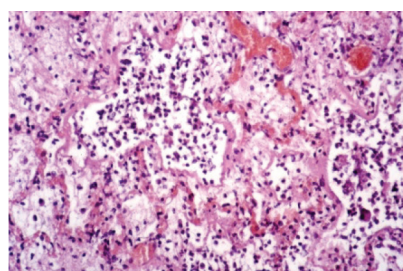
Aspergillus brasiliensis ATCC 9642

This fungi is a conidiophore, or a sexual spore generating aerobic fungus. *A. brasiliensis*, formerly listed as a strain of *A. niger*, is related to other *Aspergillus* species in that they produce spores which are highly resistant to chemical and environmental conditions. *A. brasiliensis* is commonly used as a benchmark fungus for antimicrobial fungicides and preservatives used in pharmaceutical and personal care products.



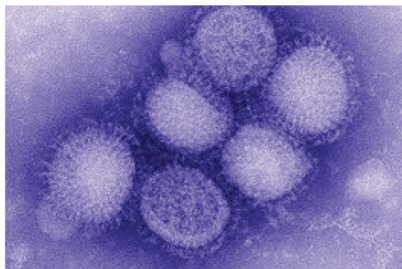
Enterococcus faecalis (VRE) ATCC 51299

This bacteria is a Gram-positive, spherical-shaped strain of *Enterococcus faecalis* that has developed resistance to the antibiotic vancomycin. *E. faecalis* (VRE) can cause a variety of local and systemic infections including endocarditis, bacteremia, and urinary tract infections, which are exceptionally difficult to treat because of this strain's acquired drug- resistance. Due to this bacterium's robust survival factors and resistance to commonly used antimicrobial agents, this bacterium is very challenging to disinfect.



Feline calicivirus (FCV), ATCC VR-782

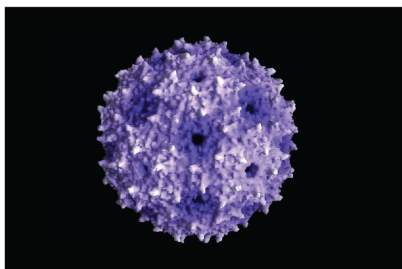
This virus is a non-enveloped, positive-stranded RNA member of the genus *Vesivirus*, and a common cause of respiratory infections in cats. Symptoms of infection in felines include nasal discharge and mouth ulcers. As a member of the *Caliciviridae* viral family, FCV is closely related to human noroviruses, which cause acute gastroenteritis marked by nausea, vomiting, and diarrhea. Unlike human norovirus, however, a simple cell culture assay system is available for FCV. Therefore, feline calicivirus is the US EPA-approved surrogate microorganism for human norovirus label claims. Both FCV and human norovirus are able to remain viable on environmental surfaces for extended periods of time and are resistant to a number of disinfectant actives. Permissive Host Cell Line Selected for FCV: CRFK (Crandell-Rees Feline Kidney Cells), ATCC CCL-94



Influenza A (H1N1)

Influenza A virus is an enveloped, minus-stranded member of the family Orthomyxoviridae, and causative agent of the illness influenza (which is more widely recognized by the term 'flu'). Influenza is more serious than other seasonal mild, respiratory tract infections (e.g. the common cold) with symptoms that can last for upwards of several weeks. Young children and the elderly are particularly susceptible to severe illness and death due to infection. Influenza is readily transmitted via infective aerosols direct contact with infective respiratory secretions. Potential transmission by contaminated environmental surfaces (fomites) has increasingly become of interest, and Influenza virus is highly vulnerable to inactivation by drying and exposure to variety of disinfectant actives.

Permissive Host Cell Line Selected for Influenza A (H1N1): MDCK (Madin Darby Canine Kidney Cells), ATCC CCL-34



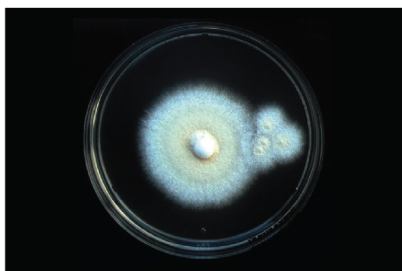
MS2 Bacteriophage (MS2), ATCC 15597-B1

This virus is a non-enveloped positive-stranded RNA virus of the bacteriophage family Leviviridae. Bacterial cells are the hosts for bacteriophages, and E. coli 15597 serves this purpose for MS2 bacteriophage. Its small size, icosahedral structure, and environmental resistance has made MS2 ideal for use as a surrogate virus (particularly in place of picornaviruses such as poliovirus and human norovirus) in water quality and disinfectant studies. Permissive Host Cell System for MS2: Escherichia coli, 15597



Staphylococcus aureus (MRSA) ATCC 33592

This bacteria is a Gram-positive, cocci shaped, aerobe which is resistant to the penicillin-derivative antibiotic methicillin. MRSA can cause troublesome infections, and their rapid reproduction and resistance to antibiotics makes them more difficult to treat. MRSA bacteria are resistant to drying and can therefore survive on surfaces and fabrics for an extended period of time and therefore makes this bacteria an excellent representative for antimicrobial efficacy testing on surfaces.



Trichophyton interdigitale ATCC 9533

Trichophyton interdigitale is a fungus that is part of a group known as dermatophytes. This fungus is known to cause a skin infection known as Dermatophytosis or Ringworm which appears on a person's skin as an inflamed circular pattern. This fungus produces spores which are difficult to eliminate via disinfection. Disinfection is especially important for environments where Ringworm infections can occur and spread rapidly such as athletic facilities or schools.

- 1 Alfa et al. AJIC 2015. 43: 141-146
- 2 (<https://www.cdc.gov/hai/surveillance/index.html>).
- 3 R. Douglas Scott II, Economist 2009 March The direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention
- 4 Huslage K, Rutala WA, Weber DJ, IHCE. 2013; 34:211-212
- 5 Carling PC, Parry MF, Von Beheren SM. Healthcare Environmental Hygiene Study Group. Identifying opportunities to enhance environmental cleaning in 23 acute care hospitals.
- 6 Evolving Technologies for Healthcare Environments by Robert A. Garcia, BS, MT(ASCP), CIC, FAPIC
- 7 A prospective study of transmission of Multidrug-Resistant Organisms (MDROs) between environmental sites and hospitalized patients—the TransFER study by Luke F. Chen MBBS, MPH, MBA, CIC, FRACP, FIDSA, FSHEA1,2, Lauren P. Knelson MSPH1,2, Maria F. Gergen MT(ASCP)4, Olga M. Better BS3, Bradley P. Nicholson PhD3, Christopher W. Woods MD, MHS1,3, William A. Rutala PhD, MPH4, David J. Weber MD, MPH4, Daniel J. Sexton