EFFICACY SUMMARY

In Vitro Test Results

The following pathogens were killed within 30 seconds after exposure to X3 CLEAN hand sanitizer:

(Community Based MRSA)	
Escherichia Coli (ATCC # 43888)	99.9999%
Salmonella enterica enterica (ATCC # 10708)	99.9999%
Staphylococcus aureus aureus MRSA (ATCC # 33593)	99.9999%
Staphylococcus aureus aureus MRSA (ATCC # 700698)	99.9998%
Staphylococcus aureus NARSA Strain (NRS123 – USA400)	99.9999%
Staphylococcus aureus NARSA Strain (NRS22 – USA600)	99.9996%
Enterococcus faecalis	99.9999%
Pseudomonas aeruginosa	99.9999%
Serratia marcescens	99.9999%
Staphylococcus aureus aureus	99.9999%

In vitro tests performed by Bioscience Labs, Inc. Bozeman, MT

Virucidal Suspension Test Results

The following viruses were killed within 30 seconds after exposure to X3 CLEAN Hand Sanitizer:

Rotavirus	99.99999%
Norwalk Virus	99.999%
Coronavirus 229E**	99.99%
H1N1 Influenza A 2009	99.44%
HIV	99.90%

(*Surrogate Murine Norovirus – CDC Recommended Surrogate)

Virucidal Suspension Test performed by Microbiotest Labs, Inc. Washington, DC

*** Virucidal Suspension Test performed by Bioscience Labs, Inc. Bozeman, MT*

In Vitro Test Results

The following pathogens were killed within 15 seconds after exposure to a .13% Benzalkonium Chloride based Foam hand sanitizer:

Candida albicans
Escherichia coli
Enterococcus faecium (VRE)
Micrococcus luteus
Proteus mirabilis
Serratia marcescens
Staphylococcus aureus (MRSA)
Staphylococcus epidermidis
Staphylococcus saprophyticus
Herpes simplex virus Type 1
Trichophyton mentagrophytes
Apergillis niger
Candida keyfr
Enterococcus faecalis
Klebsiella pneumonia
Pseudomonas aeruginosa
Salmonella typhimurium
Staphylococcus aureus
Salmonella enteritidis
Staphylococcus haemolyticus
Streptococcus pyogenes

In vitro performed by SCI Laboratories Inc.; revised protocol of CFR 333.470, Woodward Laboratories, Inc.; revised protocol of CFR 333.470, Viromed Laboratories, Inc.; revised protocol of ASTM E1052, and ATS Laboratories, Inc.; protocol of WLI01041603.COR

X3 clean

Time Kill Study Summary:
15 Seconds
Active: .13% Benzalkonium Chloride

Organism:	ATCC #	% Reduction
Gram Postive Bacteria:		
Clostridium difficile	9689	99.9999 %
Enterococcus faecalis	29212	99.9999 %
Enterococcus faecalis Vancomycin Resistant (VRE)	51575	99.99 %
Listeria monocytogenes	19117	99.9 %
Staphylococcus aureus	6538	99.9999 %
Staphylococcus aureus Methicillin Resistant (MRSA)	33592	99.9 %
Staphylococcus epidermidis	12228	99.999 %
Streptococcus pneumonia	6305	99.999 %
Streptococcus pyogenes	19615	99.999 %
Gram Negative Bacteria:		
Campylobacter jejuni	29428	99.999 %
Escherichia coli	11229	99.999 %
Escherichia coli O157:H7	35150	99.999 %
Klebsiella pneumoniae	4352	99.999 %
Pseudomonas aeruginosa	15442	99.9999 %
Salmonella choleraesuis serotype enteritidis	4931	99.9999 %
Salmonella choleraesuis serotype paratyphi	8759	99.9999 %
Salmonella choleraesuis serotype pullorum	19945	99.9999 %
Salmonella choleraesuis serotype typhimurium	23564	99.999 %
Salmonella typhi	6539	99.999 %
Serratia marcescens	14756	99.9999 %
Shigella dysenteriae	13313	99.999 %
Shigella flexneri	12022	99.99 %
Shigella sonnei	25931	99.9999 %
Vibrio cholera	11623	99.999 %
Xanthomonas axonopodis (Citrus Canker)	49118	99.99 %
Yersinia enterocolitica	23715	99.99 %

*

BEZALKONIUM CHLORIDE AS EFFECTIVE AS ALCOHOL

MORE EFFECTIVE THAN TRICOLSAN & IODENE

The December 2009, study "**Hand Hygiene In Controlled Environments " shows that both Benzalkonium Chloride (BC) and 62% Alcohol have the same effectiveness against both Bacteria and Viruses. See below for the summary:**

ETOH = 62% ETHANOL ALCOHOL / IPA = 62% ISOPROPANOL ALCOHOL /
BC = .3% BENZALTHONIUM CHLORIDE (SIMILAR TO .13% BENZALKONIUM CHLOIDE)
PVP-1 = 10% POVIDONE-IODENE / TRICLOSAN LIQUID SOAP .15%

Virus	Antiseptic					
	EtOH, IPA, BC Active Ingredient		PVP-I Active Ingredient		Triclosan Liquid Soap	
	15s	60 s	15s	60 s	15s	60 s
Herpes (DNA) (E)	5	5	5	5	4	4
Influenza A (RNA) (E)	5	5	3(1)	3(1)	0	0
Adeno (DNA) (N)	0	0	0	0	0	0
Rhino (RNA) (N)	0	0	0	0	0	0
Polio (RNA) (N)	0	0	0	0	0	0
FCV (RNA) (2) (N)	0	0	0	0	0	0
HAV (RNA) (N)	0	0	0	0	0	0
Spectrum	2/7 = 28%		2/7 = 28%		1/7 = 14%	

E = Enveloped (lipid or lipophilic)
N = Naked (non-lipid or hydrophilic) (non-enveloped)
0 = Inactive, no virus recovered at lowest dilution of virus – antiseptic mixture inoculated into host
5 = Complete inactivation (≥ 99.999%) See Table 1
(1) Lesser effect possibly due to inactivation by allantoic fluid protein
(2) FCV is surrogate for the Norwalk agent (Noroviral Enteritis)

Note: The above strain is H3N2, 1968 pandemic. Influenza A is divided into subtypes either seasonal or novel, e.g. H1N1 (current swine pandemic), H2N2 (1957 human pandemic), H5N1 (1998 bird flu). Humans are infected only with H1, H2, or H3.

Table 2: Narrow Spectrum Antiviral Suspension Tests In Vitro Rapid Inactivation Times Enveloped and Non-Enveloped Viruses < Based on ASTM E-1052[7] > (Log reduction (LR) values as pertain to hand hygiene)

Organism	Antiseptic – LR Value			
	EtOH, IPA, BC*, PVP-I Active Ingredient		Triclosan 0.15% Liquid Soap	
	15 s	60 s	15 s	60 s
Gram-Positive Bacteria				
1. *Staphylococcus aureus* (MRSA) (CA)	5	5	3	4
2. *Enterococcus faecium* (VRE)	5	5	4	5
3. *Streptococcus pyogenes*	5	5	5	5
4. *Staphylococcus aureus*	5	5	0	2
5. *Staphylococcus epidermidis*	5	5	0	2
Gram-Negative Bacteria				
6. *Escherichia coli*	5	5	0	0
7. *Proteus mirabilis*	5	5	0	0
8. *Klebsiella pneumoniae*	5	5	0	0
9. *Pseudomonas aeruginosa*	5	5	0	0
10. *Salmonella typhi*	5	5	0	0
11. *Acinetobacter baumannii*	5	5	0	2
Yeast				
12. *Candida albicans*	5	5	0	0
Spectrum	12/12 = 100%		3/12 ≥ 25%	

LR
5 = complete kill ≥ (99.999% kill)
4 = 99.99% kill
3 = 99.9% kill
2 = 99% kill
0 = Inactive, No Reduction
MRSA = Methicillin-resistant Staphylococcus aureus
CA = Community Associated
VRE = Vancomycin-resistant enterococcus

*Effects seen with Benzethonium chloride in this study probably would apply to other quaternary ammonium compounds, e.g. Benzalkonium chloride, etc.

Table 1: Antibacterial Suspension Tests In Vitro Rapid Kill Times < After ASTM E-2315 > (Log reduction (LR) values as pertain to hand sanitizing)

Hand Hygiene In Controlled Environments
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