SAFELife Corp.

Triosyn Iodinated Resin Incorporated Into Disposable Respirators

Triosyn™

Objective

- To increase awareness of the need for better respiratory protection against viral hazards relevant to potential Medical and Bio-weapon threats

Relevance To Homeland Security

Care Givers During SARS

- Healthcare providers acquired SARS despite despite masks and respirators

Toronto	51%
Hanoi	63%
Hong Kong	46%

Currently $600,000,000 Toronto law suits

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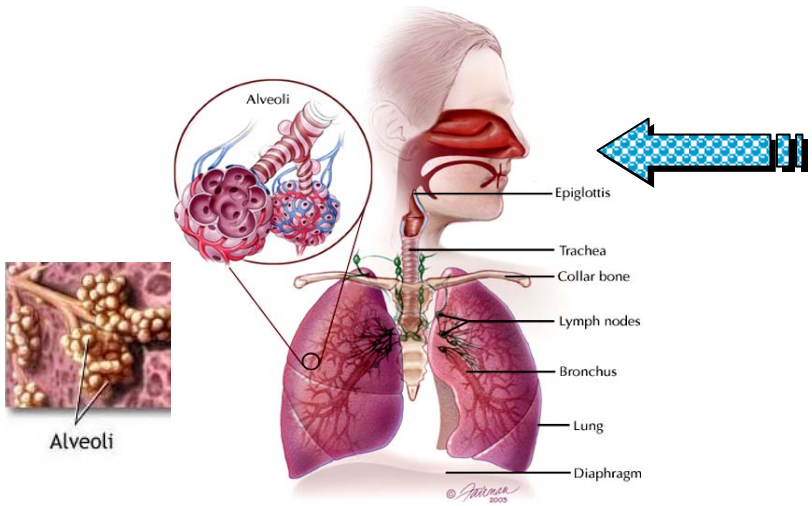
Exposure Potential

- Inhalation: Suck in air like a vacuum cleaner
  - 6 liters/min. (1½ gallons)
  - 360 liters/hr. (90 gallons)
  - 2,880 liters/8hr shift (720 gallons)!

- 300 million alveoli (air sacs) in adult lung
  - surface area if each opened = ~140 sq. yards = tennis court!



Virus

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Mission Critical:

Protect Vulnerable Respiratory Access Route

Protect Our Protectors

PAPRs, SCBA, Disposable Respirators, Masks

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Balazy 2006

Penetration of virus at 85 LPM		If 10,000 viruses in inhaled air/4 hours
20.5%	(A) Mask	2,050
84.5%	(B) Mask	8,450
5.6%	(D) Respirator	560

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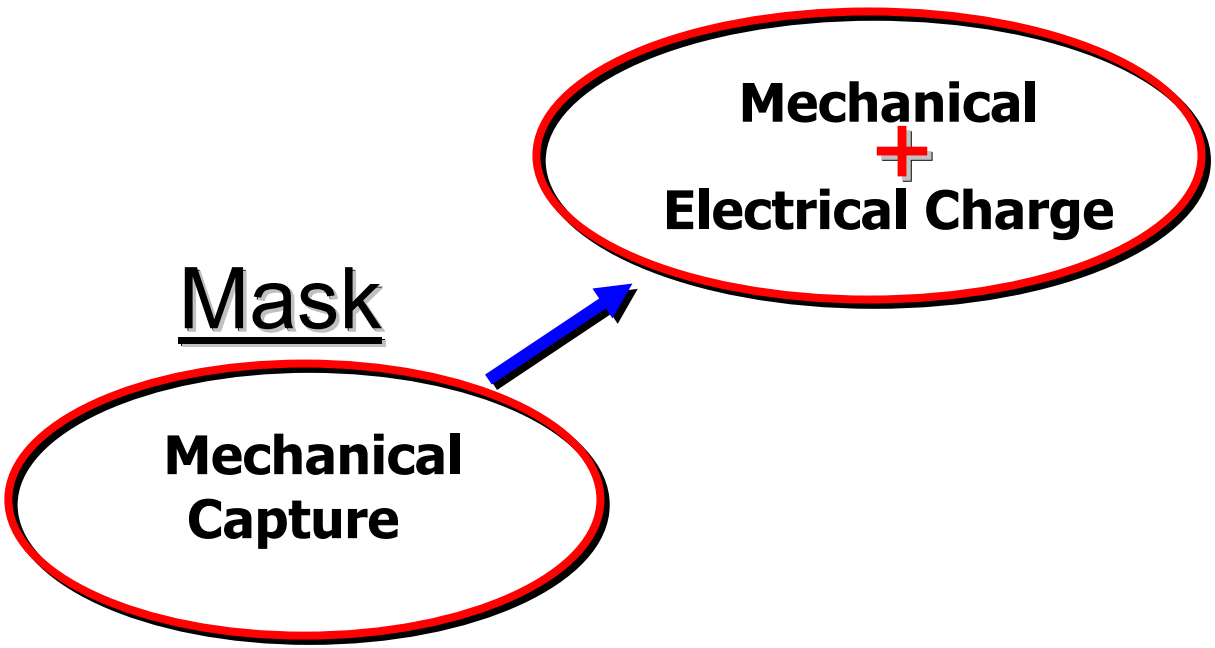
Balazy A., *Amer Jour Infect Control* 2006; 34: 52-57

Potential Airborne Viral Threats	Infectious Dose	Associated Diseases	Size Comparison Representation
Ebola & Marburg; Crimean Congo Bolivian; Rift Valley Fever; New World Arenavirus; Hantavirus; Lassa; Yellow Fever;	1-100	Viral hemorrhagic fever (VHF) Infectious dose	
Eastern, Western & Venezuelan Equine Encephalomyelitis (EEE, WEE, and VEE) viruses	10-100	Viral encephalitis	
Adenovirus	1-100	Respiratory infections, tumors	
Influenza A virus; Avian flu H5N1, H2N2, H1N1, H3N2, etc.	1-740	Influenza	
SARS Coronavirus	1-100	Sudden Acute Respiratory Syndrome (SARS)	
Variola virus	10-100	Smallpox	
Mycobacterium tuberculosis (TB)	1-10	Pulmonary tuberculosis First time N95s in healthcare	

Technological Progress In Respiratory Protection

Disposable Respirators

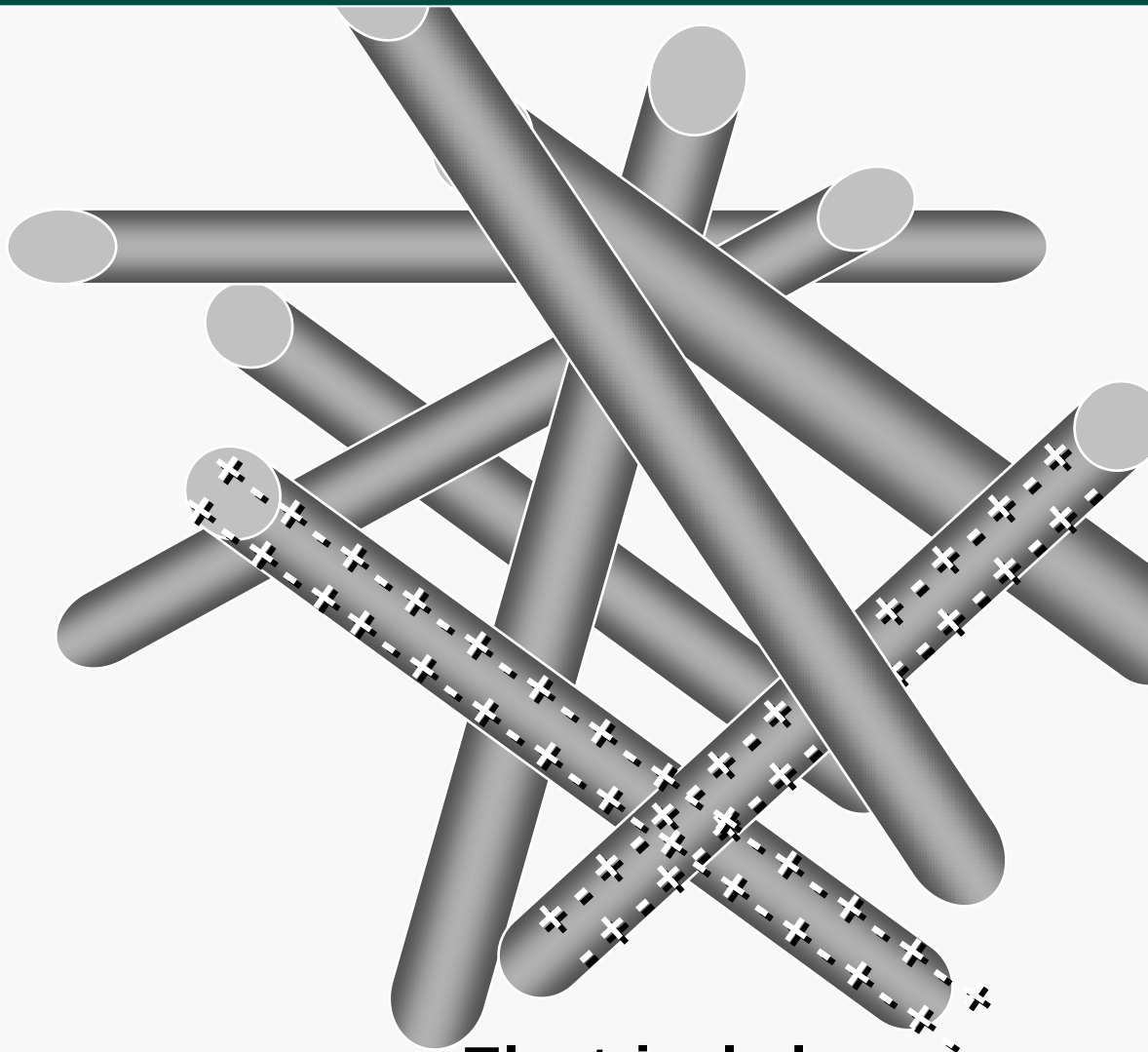


Mechanical + Electrostatic Charge

Gravitation

Impaction

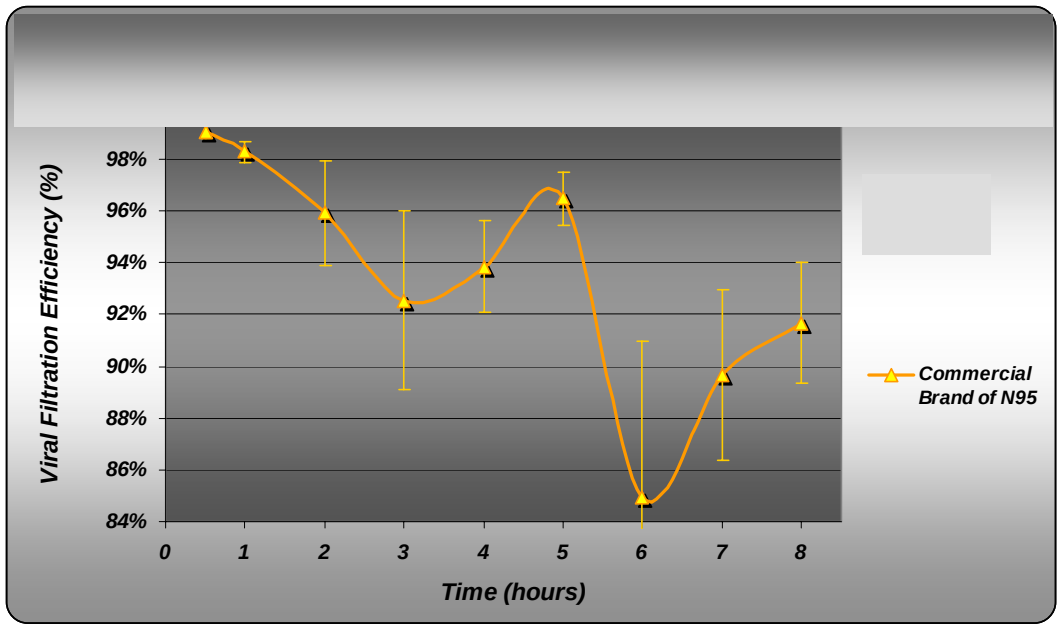
Diffusion



Electrical charge

Standard N95 Performance Degradation

- The electrostatic charge degrades over time and with different contaminates decreasing efficacy



Velocity of viral challenge: 85 LPM equivalent
Challenge: MS2 virus at approximately 1,000,000 pfu per hour
Duration: 8 hours

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How Do You Ruin The Electret Charge On Filters?

- Water
- Moisture
- Time
- Heat
- Oil based products, diesel mist, vaporized fatty tissue
- Alcohol
- Most disinfectants
- Overwhelm with captured particles; stuff

Your Own Experiment!

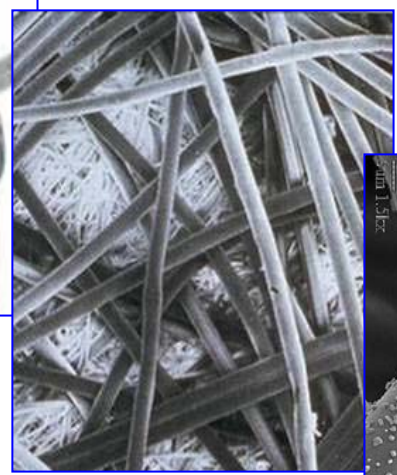
Myers DL. *Electret Media for HVAC Filtration Applications.* INJ Winter 2003; 43-54

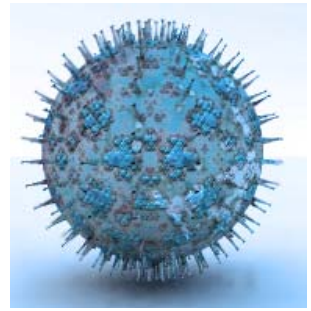
Set Up For “Migration and Dump”

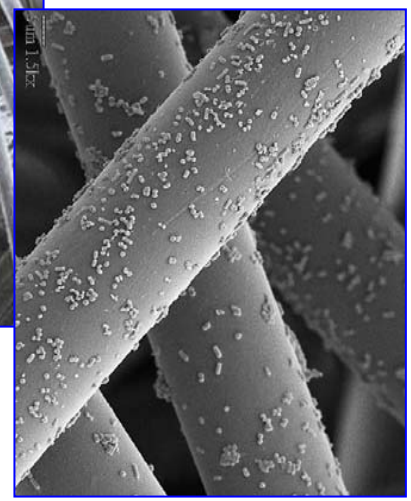
- Fibers adsorb exhaled moisture
- Moisture accumulates to form minute droplets on fibers
- Fiber’s electrostatic charge begins to decay and with it
  - Decrease in capture efficiency
  - Decrease in microbe retention

Exhalation Moisture
An Arctic Visual

A Journey Begins







Microorganisms Are Captured, But Alive On the Fibers

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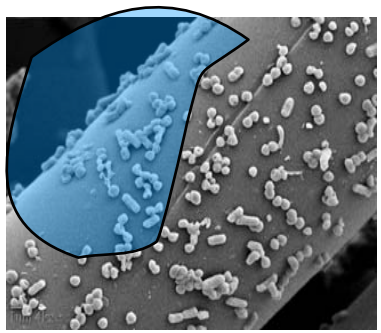
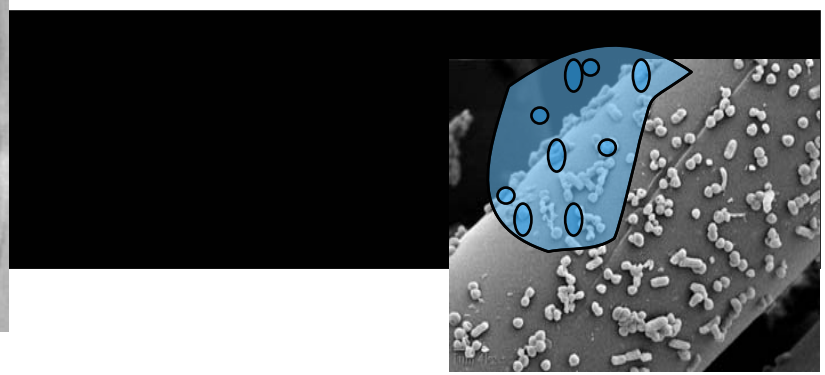
Accumulation

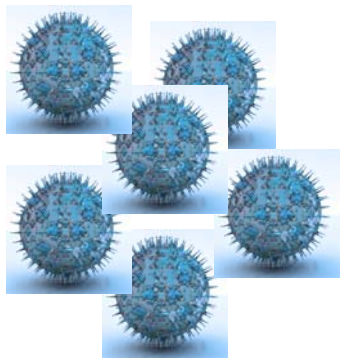
- The droplets continue to expand soaking off more and more virus and bacteria already retained on the fibers
- Remember, they are still alive



Migration and Dump

- Growing droplets reach critical mass and are pulled into the air stream, where they may be:
  - impaled onto another fiber (droplet break apart)
  - pushed back out into the environment (exhalation)
  - inhaled by the wearer (inhalation)





Mechanical + Electrostatic Charge + Antimicrobial

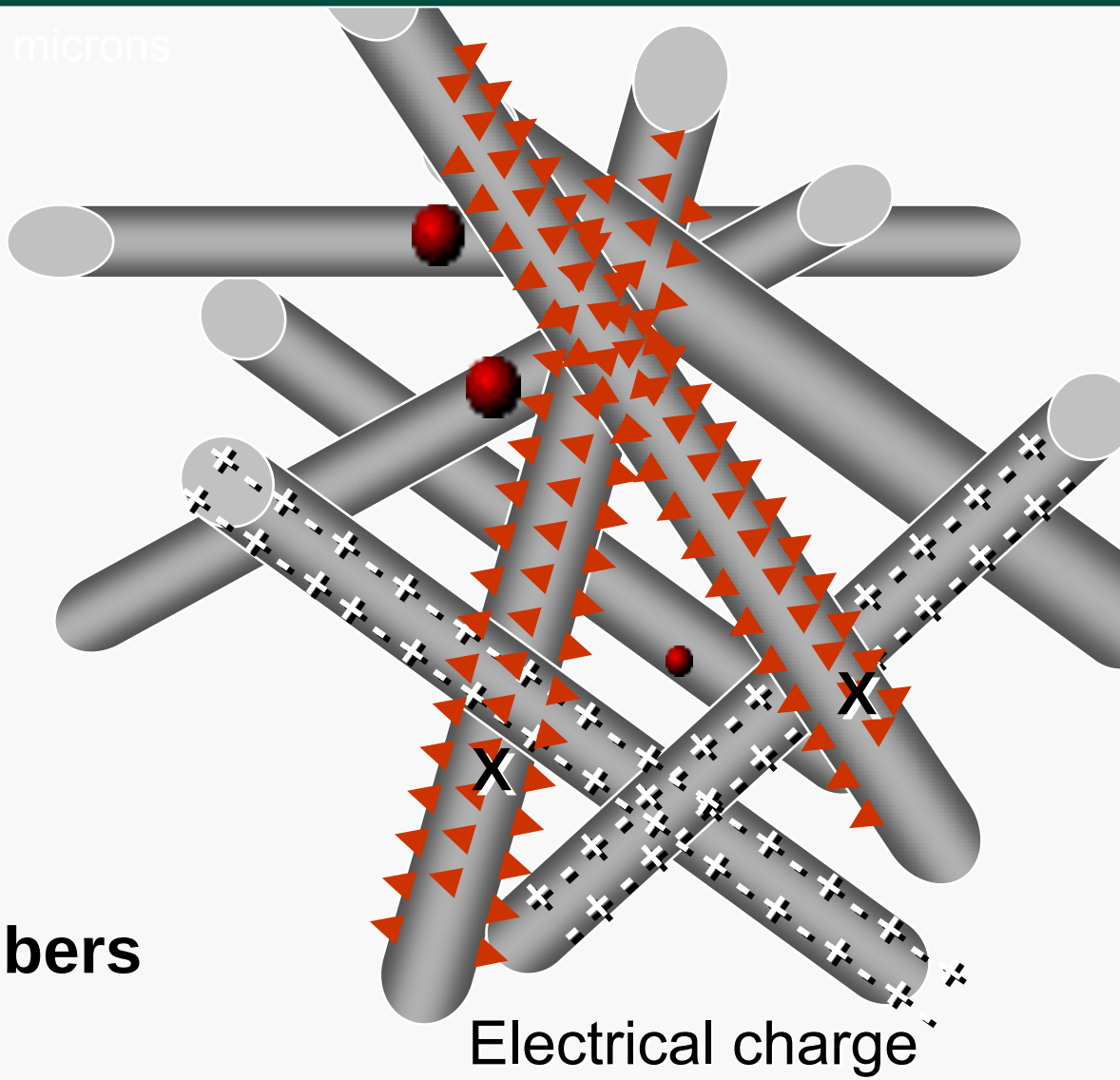
Most penetrating aerosol size: 0.3 microns

Gravitation

Impaction

Diffusion

Triosyn treated fibers



Technological Progress In Respiratory Protection

Mask

Mechanical Capture

Respirators

Mechanical + Electrical Charge

Mechanical + Electrical Charge + Antimicrobial

Triosyn Respirators all three mechanisms

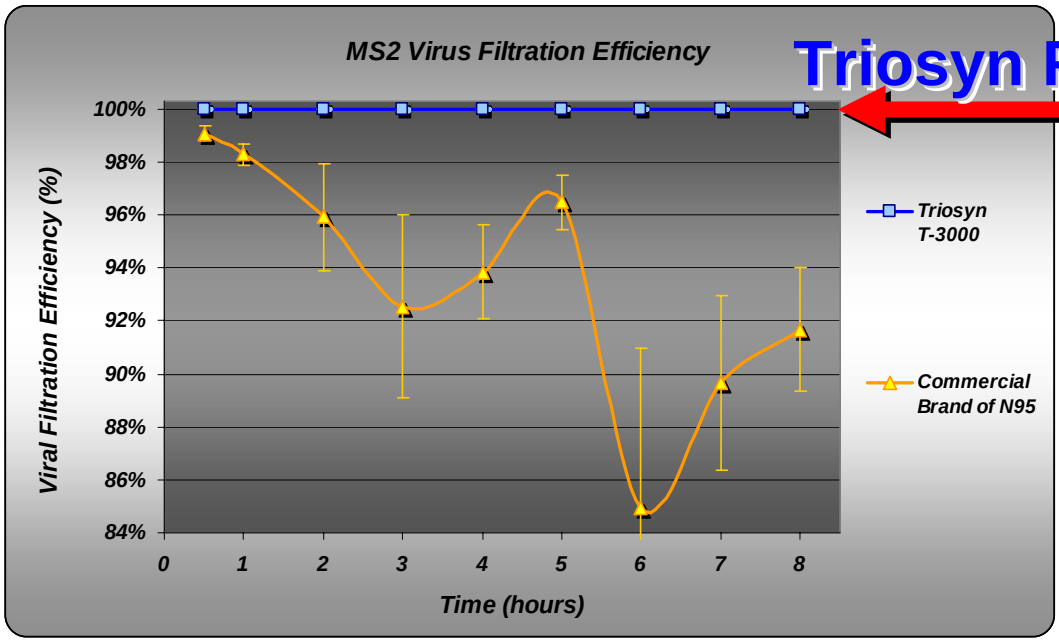
Antimicrobial Preserves Efficacy

- Counteracts the degradation affect – preserves the respirator
- Preserves higher microbial capture efficiency and prevents migration

8 hours

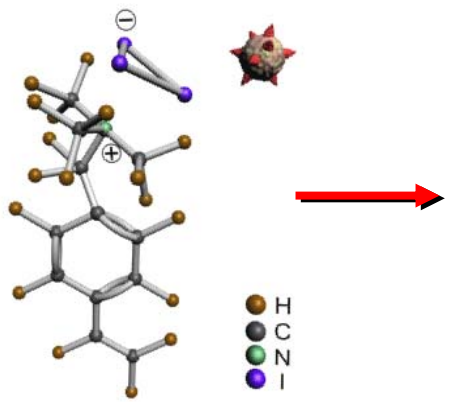
85 LPM when

Challenged with 1,000,000 viruses per hour



Triosyn Antimicrobial Technology

- Iodine (I_2) is a fast acting, broad spectrum antimicrobial utilized for wound treatment and infection prevention since the 1800s
- Historically unable to keep iodine stable over time
- Tri-iodide is thermal-fused into unique polymeric resin particles: polystyrene-4-methyltrimethylammonium-triiodide



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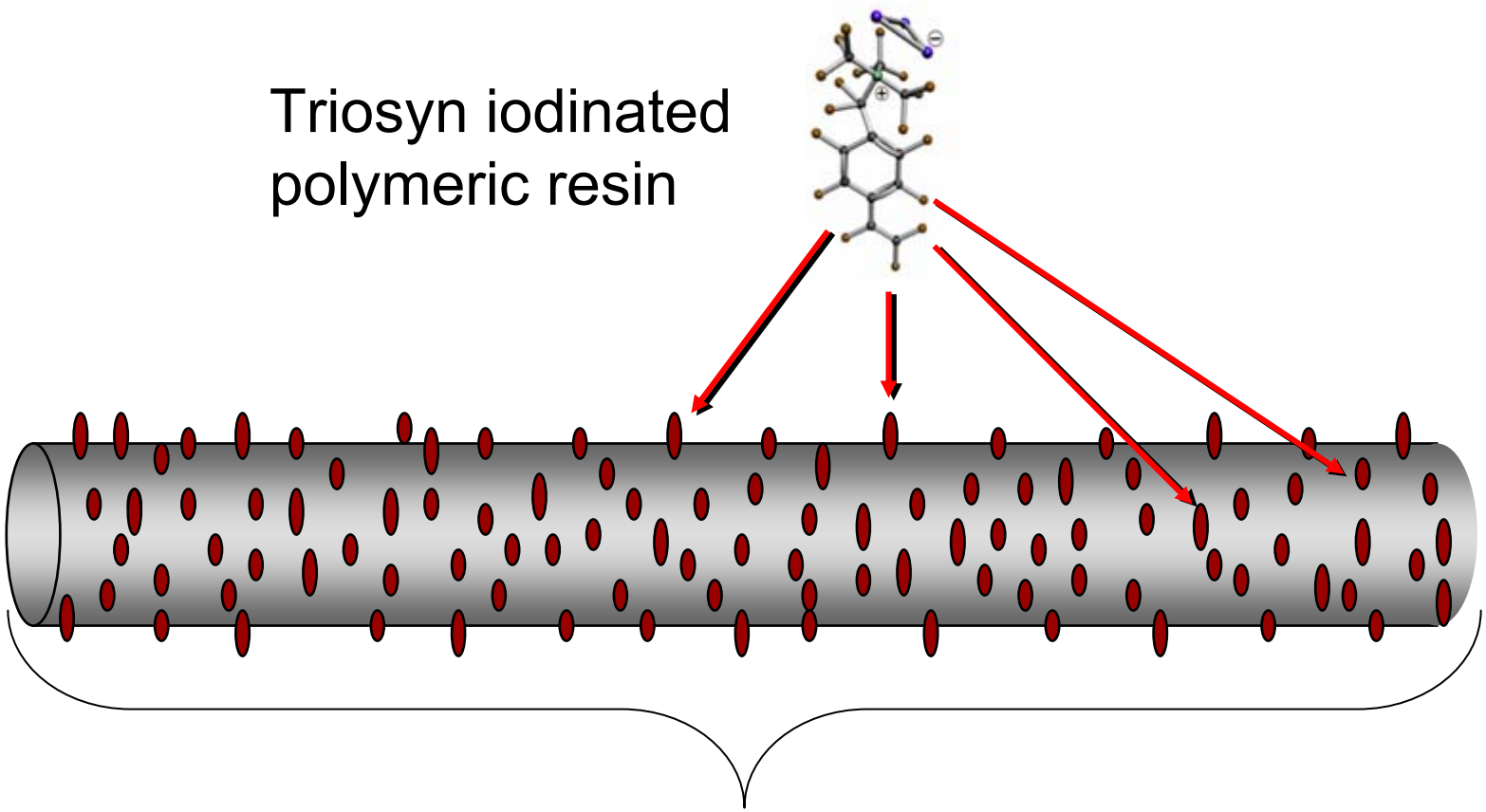
Triosyn Antimicrobial Resin On Fibers



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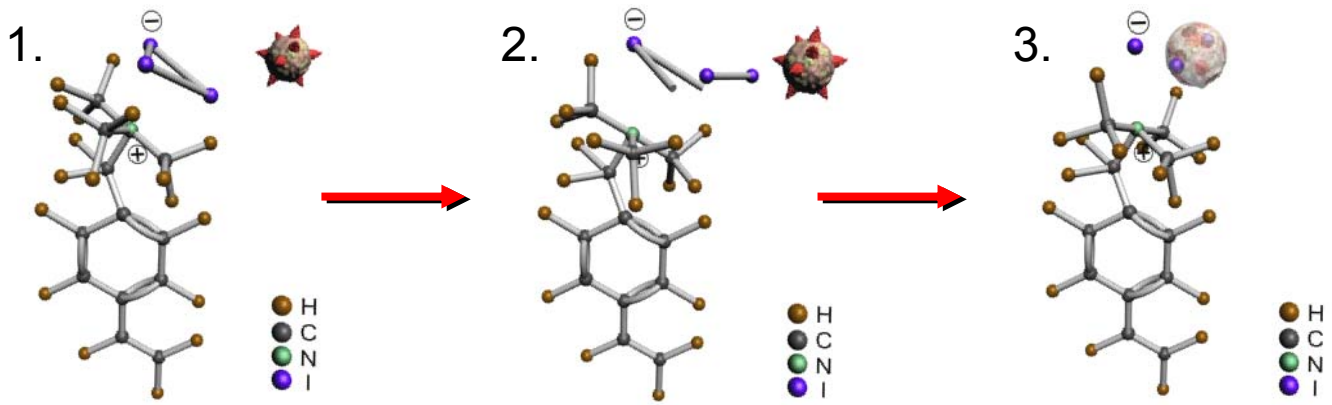
Triosyn Antimicrobial Technology

- Electrochemical bond maintains I_3^- integrity and sets up a demand–release mechanism
- I_2 is released from the I_3^- in the presence of microoganisms (direct contact not necessary)



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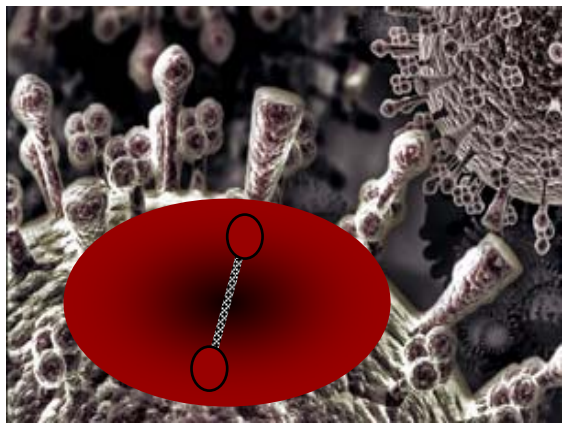
Triosyn Action

- Drawn to the surface of the microorganism
- Iodine (I_2) **oxidizes** surface and key external and internal components of the cell
- Affective against viruses, bacteria, fungi, protozoa



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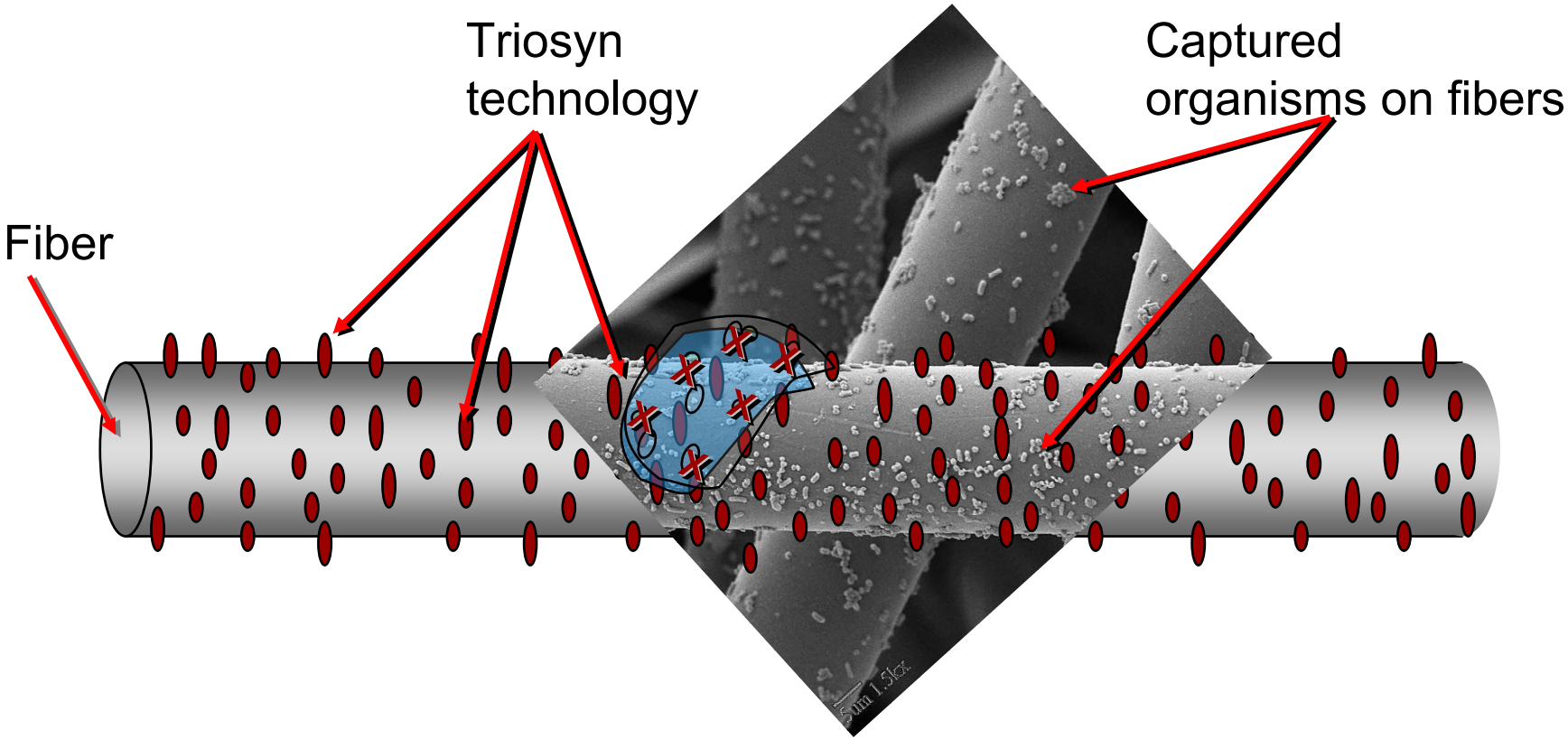
Triosyn Iodinated Resin: Addresses Both Passing Air and "Migration and Dump"



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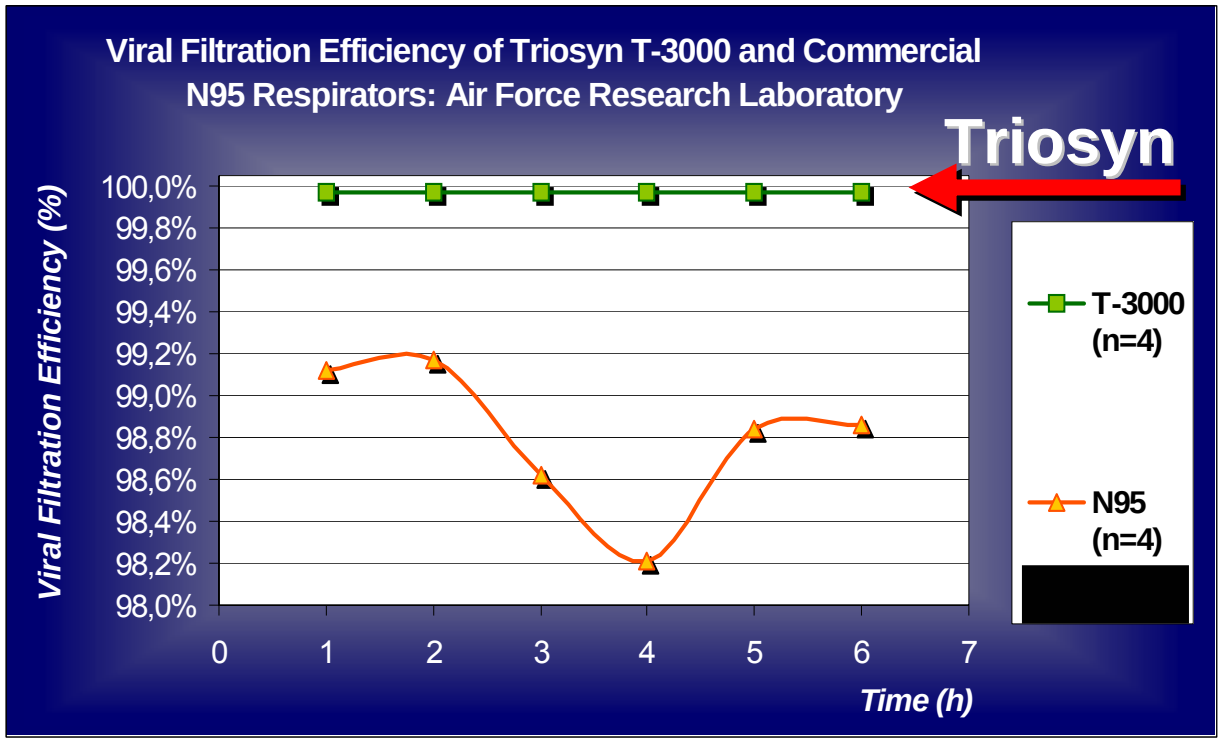
Air Force Research Lab Testing



Flow Rate: 85 LPM for 6 hours

Virus: MS2 (as per Governmental agencies protocols)

Air Force Research Laboratory (AFRL), Panama City, Florida

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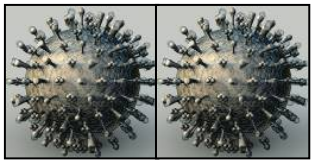
Efficacy Comparisons



Filtration Efficiency	Airborne Viral Exposure			
	100	1,000	10,000	100,000
99.999%	0.001*	0.01	0.1	1
99.90 %	0.1	1	10	100
99.00 %	1	10	100	1,000
95.00 %	5	50	500	5,000
90.00 %	10	100	1,000	10,000
20.00%**	80	800	8,000	80,000

*Viruses penetrating through respirator/mask

* *20% represents the results of a face mask

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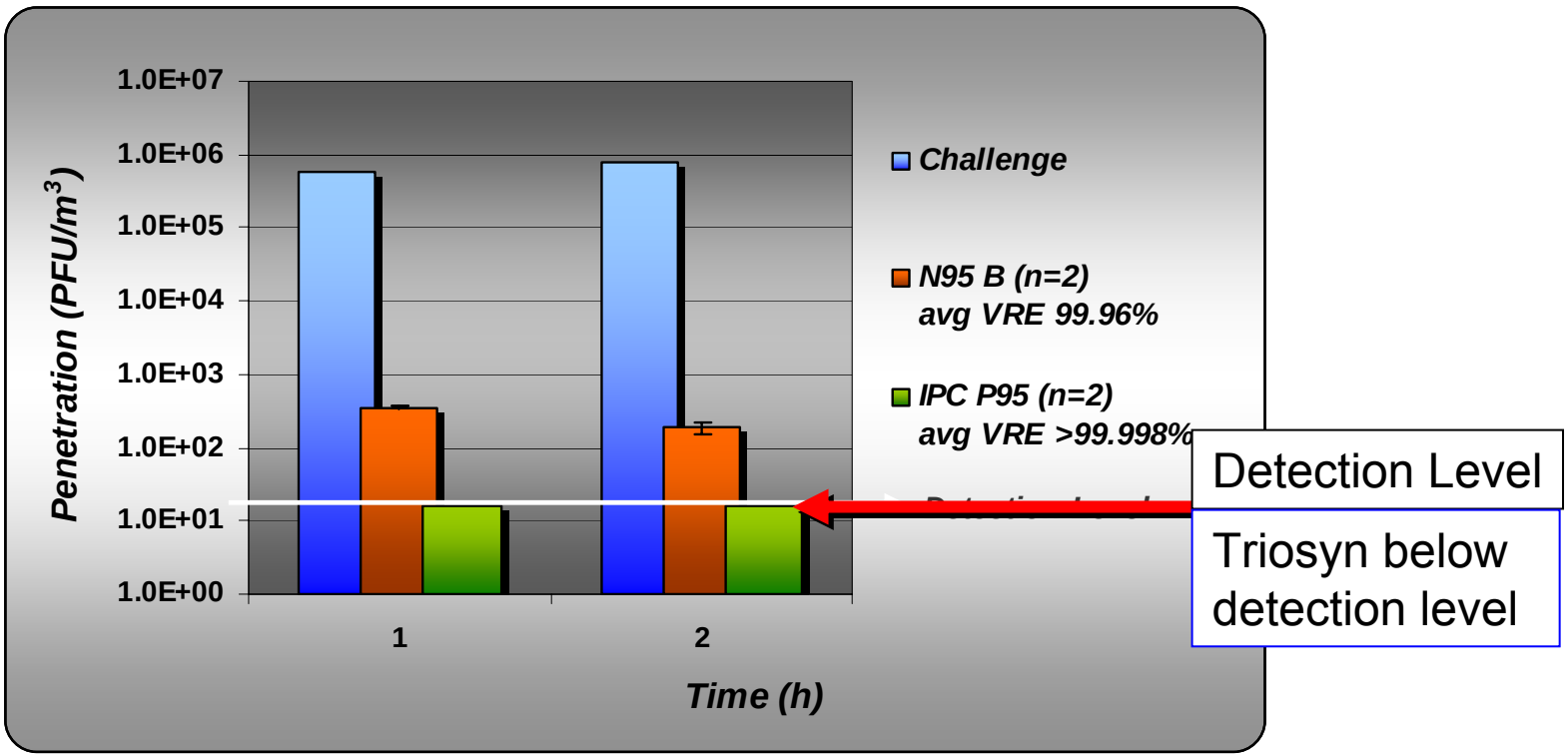
Aerosolized SARS Coronavirus

	Positive Control	Triosyn Respirators					
Sampling Time (min)	Total $TCID_{50}$ Units	Sample 1 (Total $TCID_{50}$ Units)	Sample 2 (Total $TCID_{50}$ Units)	Sample 3 (Total $TCID_{50}$ Units)	Sample 4 (Total $TCID_{50}$ Units)	Sample 5 (Total $TCID_{50}$ Units)	Sample 6 (Total $TCID_{50}$ Units)
15	**3,000**	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected
60	**30,000**	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected
120	**150,000**	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected
Total	**183,000**	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected	No Virus Detected

- 85 LPM for two hours with increasing level of SARS Coronavirus challenge
- No viruses detected during continuous collection of the air after passage through Triosyn Respirators (6 respirators tested).

Influenza A

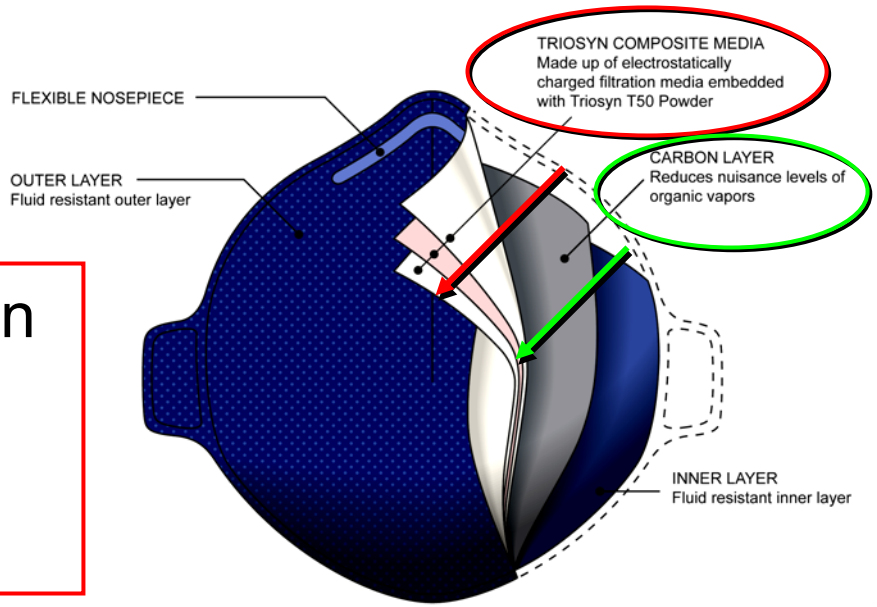
Influenza penetration levels through Triosyn P95 and Commercial N95 Respirators tested 85 LPM



M06-0246 ;July 5th 2006

Triosyn Respirators

Active Protection With Triosyn Antimicrobial Technology

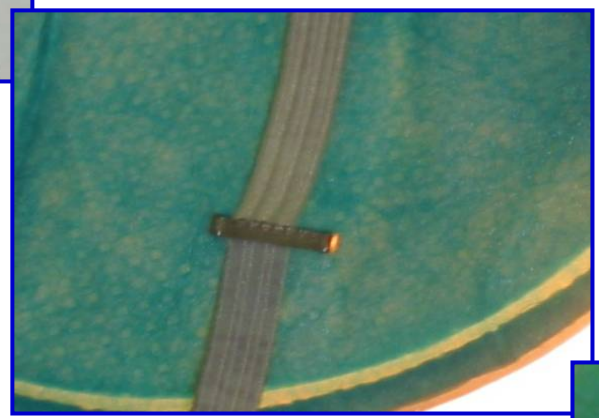


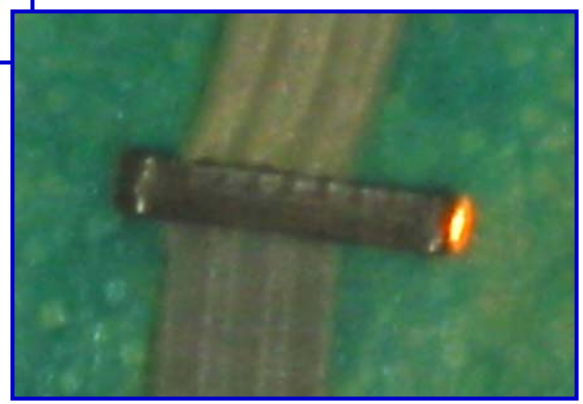
Activated Carbon absorbs odors and nuisance organic vapors

Prevents oil penetration for those with “P” designation

Fluid resistant to protect from splashes and sprays of blood and other bodily fluids

Watch Out for Staples In Filtering Portion





NIOSH testing determines Particle Filtration Efficiency of the Respirator fabric, not the finished product

Appropriate Parameters For Testing Barrier Effectiveness Against Viruses

- Appropriate preconditioning
- 0.05 to 0.1 micron inert particle challenge
- 0.05 to 0.1 micron viral aerosol challenge (virus in aerosol will be smaller, e.g. MS2)
- High humidity to reflect exhalation moisture
- 85 LPM (NIOSH) equivalent face velocity
- 3 to 24 hour test duration

Triosyn Antimicrobial Technology

- Broad spectrum: bacteria, fungi, viruses and protozoa
- Rapid activity able to interact with microorganisms in air stream passing at 85 LPM
- Biocidal (kills microorganisms) - not, just static (putting germ into hibernation)
- Bio-compatible at extended-use exposure levels
- An antimicrobial with long term use-history and expectations in a harnessed format
- Not known to instigate antibiotic resistance

Triosyn Antimicrobial Technology

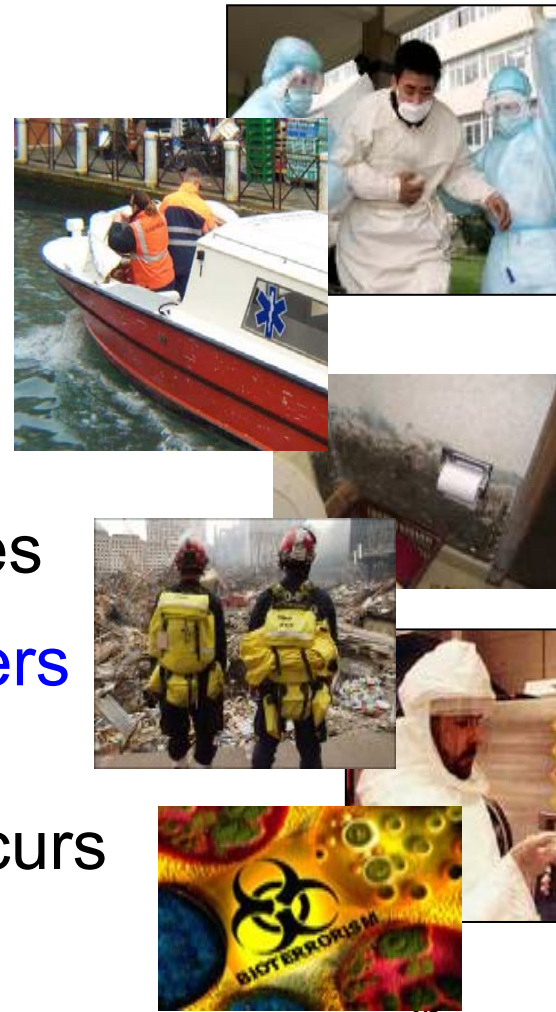
- No development of microbial-resistance to the antimicrobial has occurred to Triosyn iodinated resin
- Stable in expected manufacturing, shipping, storage, environmental and use conditions
- Effective for entire duration of use of the respirator with negligible efficacy degradation and acceptable ease of breathing – can be adjusted depending on product
- Antimicrobial not a constant leach out, but is instead delivered as needed

Reasons for Having Triosyn Disposable Respirators Available

- Exposure to serious natural or manmade airborne infectious microorganisms or infected individuals
- Threat of airborne bioterrorist attack
- Working with symptomatic poultry or other animal vectors

Reasons for Having Triosyn Disposable Respirators Available

- Cleaning up after natural disasters
  - Floods - Hurricanes - Earthquakes
- Cleanup after manmade disasters
  - Explosions - Bioterrorism
- When faced with odor and nuisance fumes
  - Cleanup - CSI - Mortuary - 1st responders
- Stock to ensure access when (not if) pandemic strikes or bioterrorist attack occurs



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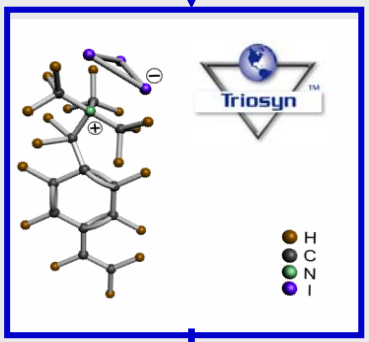
Safe Life and Triosyn Research

Innovative Product Development for the 21st Century

Various stages of product development and commercialization



Defense / Military

- Troop shelters
- Patient transports
- Body bags
- Canteen filters
- Shoe innersoles

Air Filtration

- Respirators
- Gas Mask Canisters
- HVAC Systems

Industrial

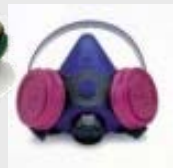
- Lubricant Filters
- Paints & Coatings
- Decontamination
- Barriers & Textiles

Medical-Hemo

- Treatment
- Transfusion

Medical-Topical

- Wound Management
- Wound Dressings & Burn Wraps
- Topical Preparations



Microbiological Performance

Microoganisms tested against Triosyn Air Filtration or Antimicrobial Finishes

Viruses	Bacteria	Bacterial spores	Fungi
Φx174 Coliphage **MS2 Coliphage** **Newcastle Disease Virus** **SARS coronavirus** **Avian & Human Influenza**	***Erwinia herbicola*** ***Escherichia coli*** ***Klebsiella pneumoniae*** ***Klebsiella terrigena*** ***Micrococcus luteus*** ***Staphylococcus aureus*** ***Staphylococcus epidermidis***	***Bacillus atrophaeus (BG)*** ***Bacillus subtilis***	***Aspergillus niger*** ***Candida albicans*** ***Cladosporium herbarum*** ***Rhodotorula rubra*** ***Trichophyton mentagrophytes***

Microbiological Performance

Microoganisms tested against Triosyn Products

Viruses	Bacteria	Bacterial Spors	Fungi	Protozoa
Φx174 Coliphage **Human Immuno. Virus (HIV)** **MS2 Coliphage** **Newcastle Disease Virus** **Poliovirus Type 1** **Rotavirus SA-11** **SARS coronavirus**	***Brucella abortus*** ***Enterobacter aerogenes*** ***Enterococcus faecalis*** ***Erwinia herbicola*** ***Francisella tularensis*** ***Klebsiella pneumoniae*** ***Klebsiella terrigena*** ***Legionella sp.*** ***Micrococcus luteus*** ***Drug-Res. Staphy. aureus (MRSA)*** ***Proteus mirabilis*** ***Pseudomonas aeruginosa*** ***Pseudomonas pseudomallei*** ***Salmonella sp.*** ***Serratia marcescens*** ***Shigella flexneri*** ***Staphylococcus aureus*** ***Staphylococcus epidermidis***	***Bacillus anthracis*** ***Bacillus atrophaeus (BG)*** ***Bacillus subtilis***	***Aureobasidium pullulans*** ***Aspergillus niger*** ***Candida albicans*** ***Cladosporium herbarum*** ***Penicillium citrinum*** ***Penicillium sp.*** ***Rhodotorula rubra*** ***Trichophyton mentagrophytes***	***Cryptosporidium parvum*** ***Giardia lamblia*** ***Giardia muris***

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