

HVAC Retrofit Solutions to improve IAQ

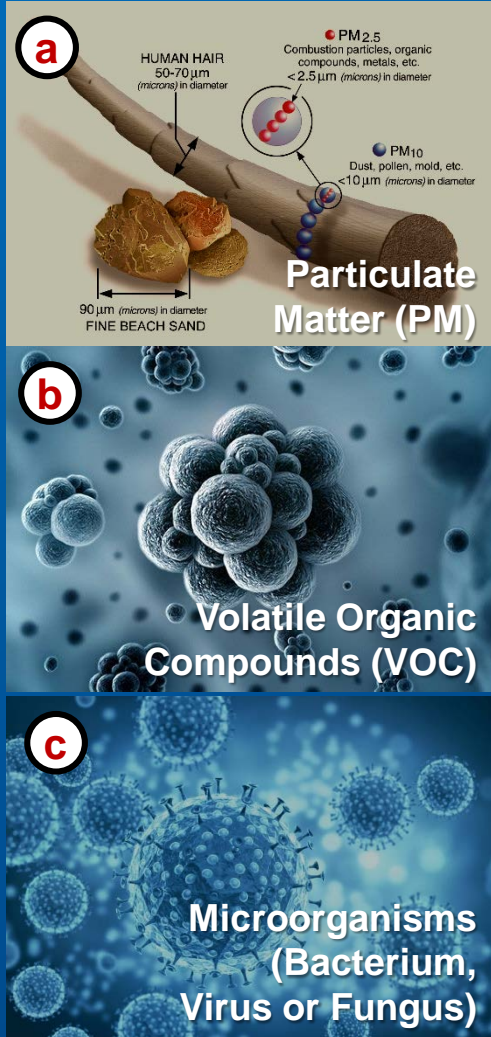
Clean air solutions for existing air systems

Ken Lim

The power behind **your mission**

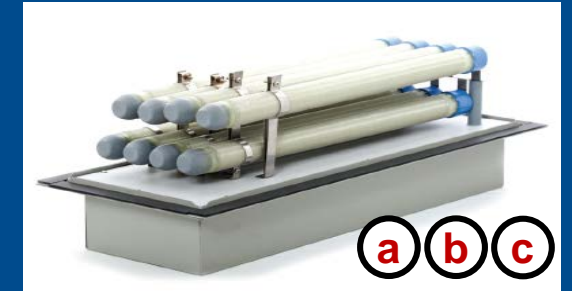
“ Indoor air quality is one of the top most urgent environmental risks to public health”

Indoor Air Quality Concerns



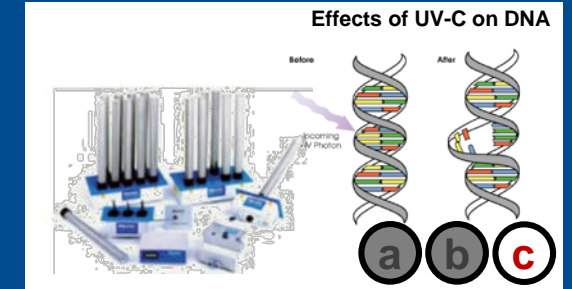
Bipolar Ionization Technology

- Microbial & pathogens reduction
- Particle decay
- VOC and odors reduction
- Energy conservation



Ultra Violet Lights

- Disinfects by passing air through ultra-violet light (UV-C).
- UV-C penetrate the cell wall of microorganisms and alter the DNA structure making them non-viable and unable to reproduce or infect.
- No significant impact to static pressure.



Electrostatic Precipitator

- Continuous high-voltage pulse sterilization.
- No consumables, can be cleaned
- Low maintenance and operation costs.
- Low air resistance.



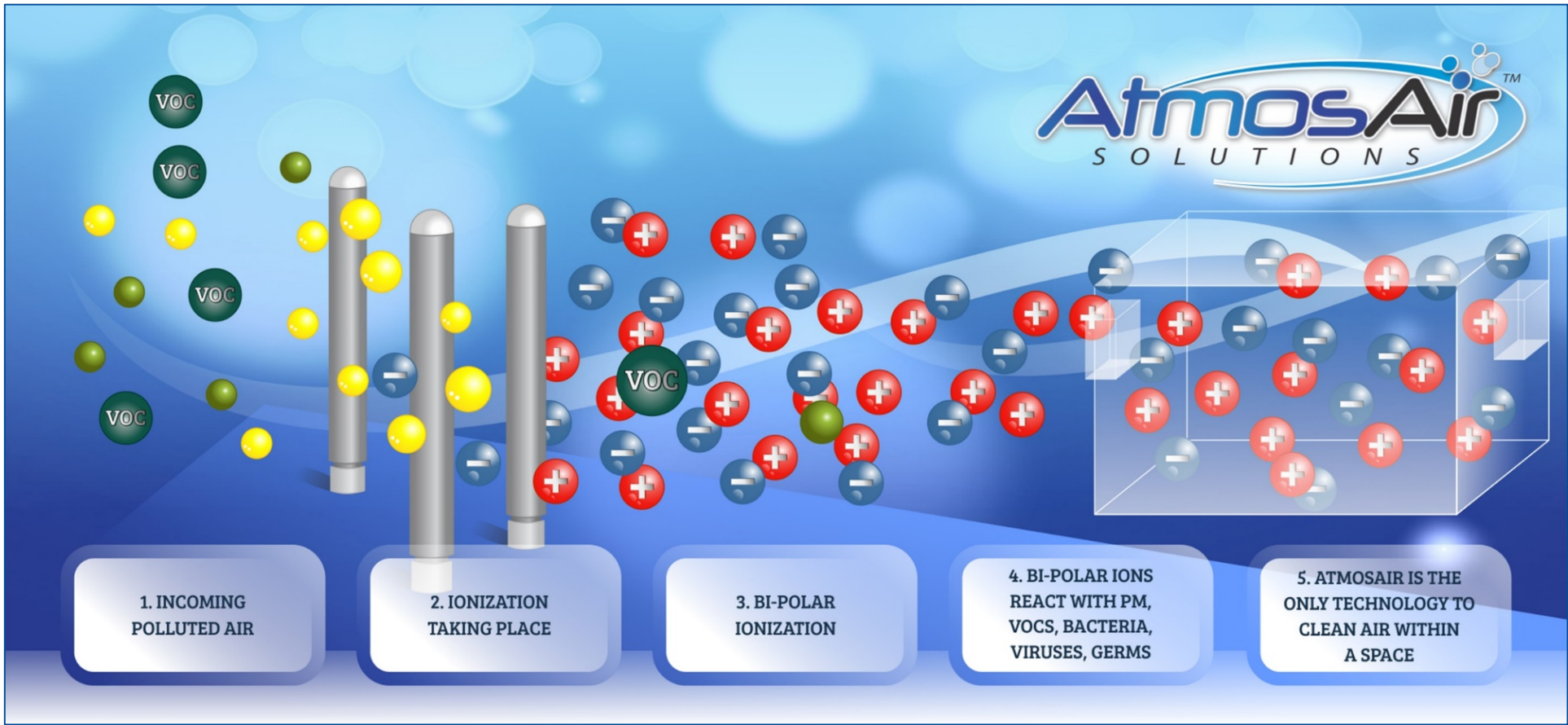
High efficiency Filters

- 35% of influenza RNA is contained with particles $>4 \mu\text{m}$ in aerodynamic diameter, 23% from $1 - 4 \mu\text{m}$, 42% $< 1 \mu\text{m}$ (#1)
- HEPA filter has proven to be 99.97% efficient to trap particles 0.3 microns and larger.
- F7 has 85% dust spot efficiency for particles $>1 \mu\text{m}$

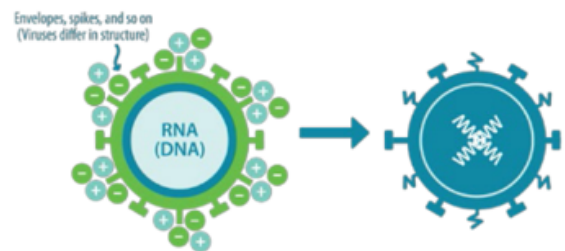


#1 Measurements of Airborne Influenza Virus in Aerosol Particles from Human Coughs

AtmosAir Bipolar Ionization Working Principle



AtmosAir Renders Airborne Viruses Inactive By Disrupting its Reproductive Cycle

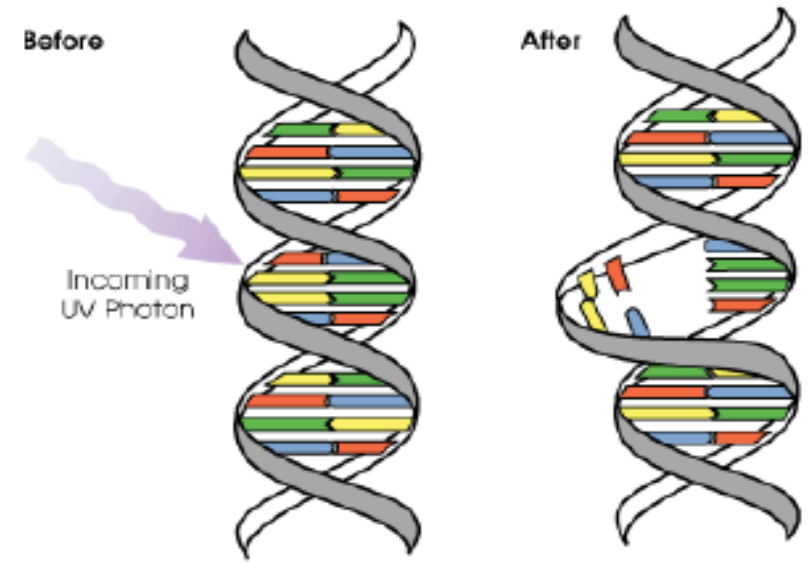


1. Ions attach themselves to virus.
2. Ions pull hydrogen molecule off of virus to combine and form water vapor.
3. Ions render virus inactive and cannot infect even if it enters the body.

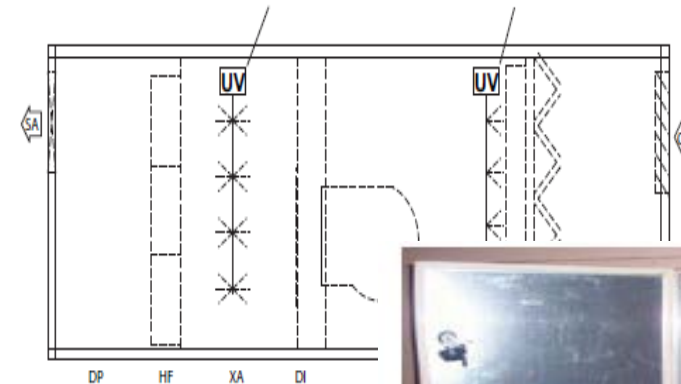


Ultra Violet Light (UV-C)

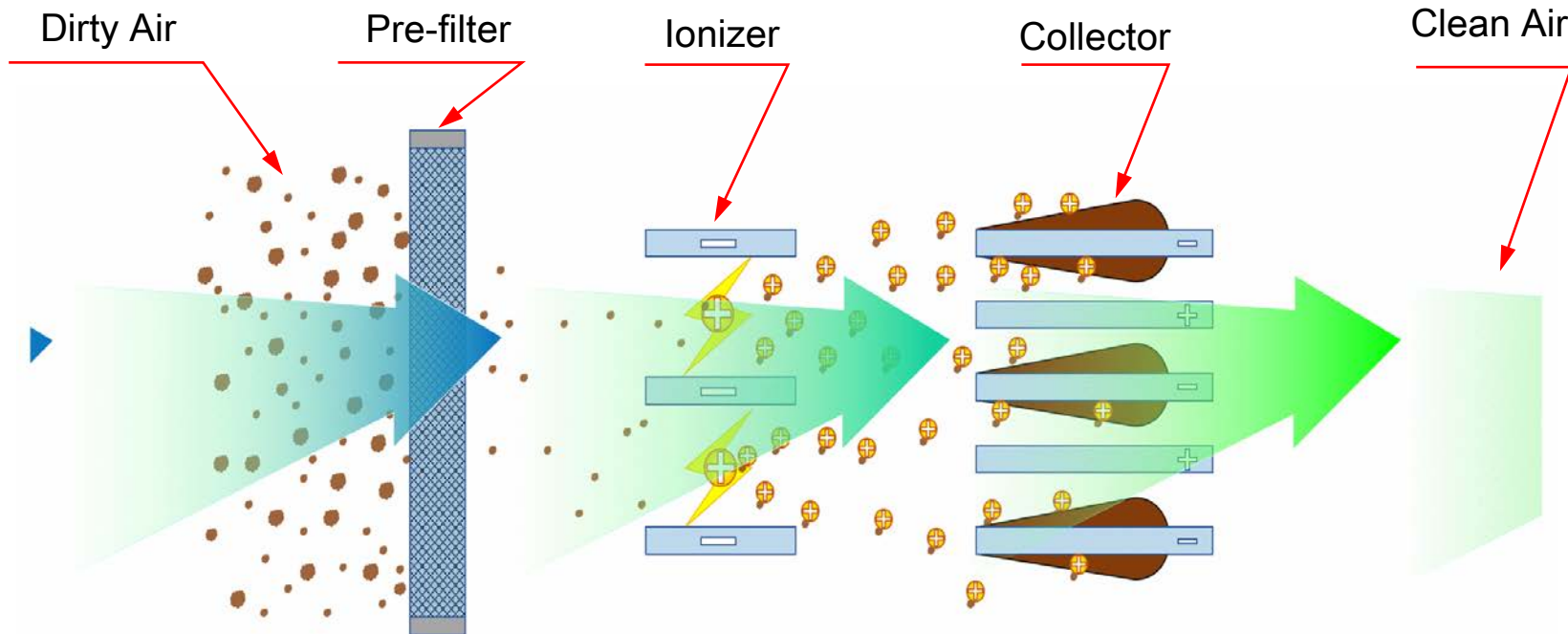
- Viral and bacterial microbes account for 60-80% of indoor air quality problem.
- The UV-C lighting options are able to penetrate the cell wall of microorganisms and alter the DNA structure such that the microorganisms becomes non-viable and unable to reproduce or infect.
- 2/3 of the viruses and bacteria are vulnerable to single pass rate.
- The remaining 1/3 become more susceptible with each additional air change as the kill rate percentage quickly increases to 99.98%.
- Effective method to kill the microorganism but the setback is that it is also dependent on contaminants being exposed to the light field for a time period long enough for the contaminant to be eliminated.
- Also, UV light can only treat contaminants that pass directly through the light field and other air such as infiltrated air from outside the room will not be treated.



EFFECTS ON DNA



Electrostatic Precipitation Working Principle



Air is drawn by the motor/blower through a pre-filter which traps large dust particles. The remaining particles, some as small as 0.01 microns, pass into a strong electrical field (ionizing section) where the particulate receives an electrical charge. The charged particles then pass into a collector plate section made up of a series of equally spaced parallel plates. Each alternate plate is charged with the same polarity as the particles, which repel, while the interleaving plates are grounded, which attract and collect.

- Dry media exhibits and increase in efficiency as they collect dirt and dust. A dry media filter is at the lowest efficiency rating when it is clean.
- The increase in efficiency corresponds to a decrease in open area as the media collects fibres and particles.
- In dust critical environments the user typically cannot wait for the increased efficiency.

Function

- Killing bacteria and viruses.
- Purifying PMs.

国家空调设备质量监督检验中心
National Center of Quality Supervision and Inspection and
Testing for Air Conditioning Equipment
检验报告
TEST REPORT

报告编号: 2017AC153
Report No. 2017AC153

样品编号
Sample No. 2017AC153

检验条件
Test Conditions
风速为 2.5m/s, 有效迎风面尺寸为 400mm×270mm, 风量为 1215 m³/h.
The wind speed is 2.5m/s, and surface size for effective ventilation is 400mm×270mm. Air flow rate is 1215 m³/h.

检验结果
Test Results

序号 No.	检验项目 Tested Items	标准要求 Standard Requests	检验结果 Test Results	单项判定 Individual Decisions
1	标志包装 Sign and Packing	在明显位置固定标识, 包装需密封, 包装箱上应注明相关标识。 Fixed the sign in obvious location, and the packing is neat and well. The packing box shall be marked with the relevant sign.	符合 Meet the requirements	合格 Qualified
2	输入功率(W) Input Power	/	38.5	/
3	PM _{2.5} 一次通过净化效率(%) Cleaning Efficiency of PM _{2.5}	/	95.7	/
4	PM ₁₀ 一次通过净化效率(%) Cleaning Efficiency of PM ₁₀	/	96.7	/
5	微生物一次通过净化效率(%) Cleaning Efficiency of Microorganism	/	95.2	/

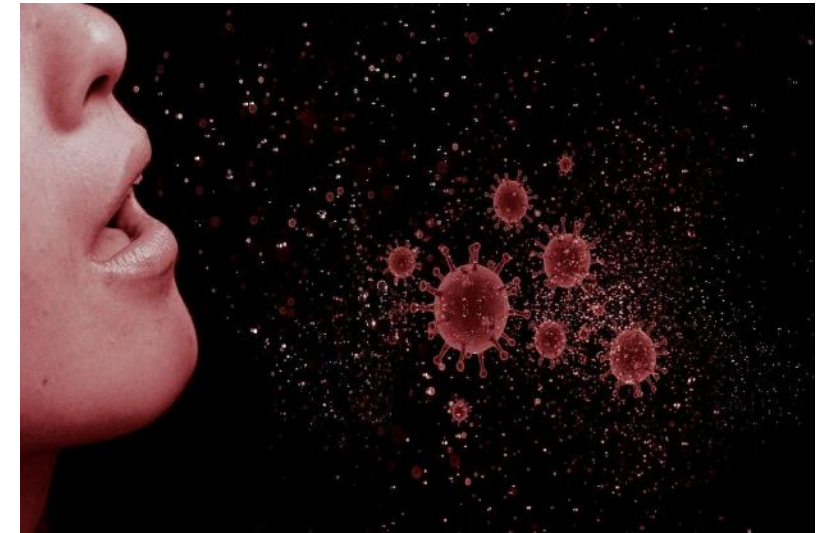
Performance

- One-pass purification eff. of microbe: 95% @ 2.5m/s
- One-pass purification eff. of PM2.5 : 95% @ 2.5m/s
- Air resistance: < 20Pa @ 2.5m/s



High Efficiency Filters

- Common Airborne Microbial Infections: Chickenpox, smallpox, influenza, measles, tuberculosis etc.
- According to the study: “Measurements of Airborne Influenza Virus in Aerosol Particles from Human Coughs” #1
 - 35% of the influenza RNA is contained with particles size $>4\mu\text{m}$ in aerodynamic diameter
 - 23% was in particle size from 1 to 4 μm
 - 42% are with particles $< 1 \mu\text{m}$
- If an air handling unit has a secondary F7 filter it means approximately 2/3 of those particles can be removed through air filtration.
- If HEPA filter of 99.97% dust spot efficiency is installed, most of those particles can be arrested.
- Most commercial buildings such as malls and offices have pre filter with around 25% dust spot efficiency and secondary filter having 60% to 85% dust spot efficiency.
- In fact, it is not surprising that in some older buildings, only pre filters are installed in air handlers



#1

Citation: Lindsley WG, Blachere FM, Thewlis RE, Vishnu A, Davis KA, et al. (2010) Measurements of Airborne Influenza Virus in Aerosol Particles from Human Coughs. PLoS ONE 5(11): e15100. doi:10.1371/journal.pone.0015100

Editor: Andrew Pekosz, Johns Hopkins University, United States of America

Received: August 16, 2010; **Accepted:** October 21, 2010; **Published:** November 30, 2010



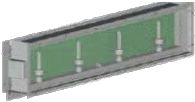


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Funding: This work was supported by internal funds from the National Institute for Occupational Safety and Health (NIOSH; part of the US Centers for Disease Control and Prevention) and by an interagency agreement with the US Environmental Protection Agency (EPA; DW7592259701). NIOSH employees were involved in conducting the study, analyzing the results, and preparing the manuscript.

Competing Interests: The authors have declared that no competing interests exist.

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Comparison of Microbial Purification Technologies

★: Low ★☆: Low to Medium ★★: Medium ★★★: High		Electrostatic Precipitator (ESP)	HEPA Filter	TiO2 Sterilizer	UV Germicidal Lamp	Bipolar Ionization
						
Performance	Microbes	★★★	★~★★★★ Depends on filter grade	★★☆	★★	★★☆
	PMs	★★★	★~★★★★	-	-	★★☆
	VOCs	-	-	★★	-	★
	Air Resistance	★	★★★	★	★	★☆
	Service Cycle	★★★★★ (10 years)	★ (3~6 months)	★☆ (1 year)	★☆ (1 year)	★★ (2 years)
		Clean every 50 days	Replace every 3~6 months	Replace every 1 year	Replace every 9000H	Replace every 17600H
Cost	Initial	\$\$	\$	\$\$	\$	\$\$\$\$
	Maintenance	\$	\$\$\$	\$\$	\$\$	\$\$\$



Thank You !