Indoor Air Quality at Food Factory

Bi-polar Ionizer

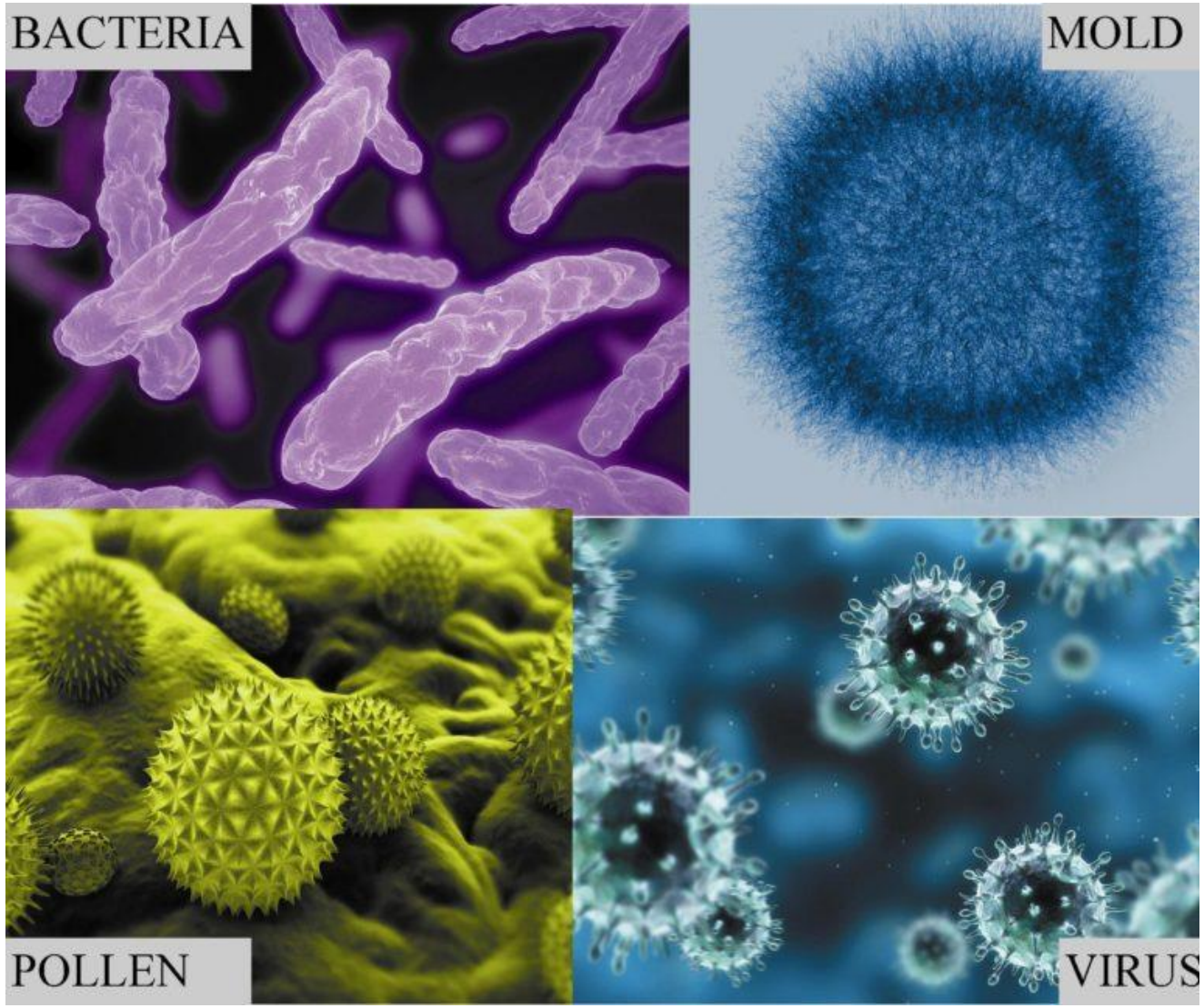
STERIONIZER

How Products Spoil – Challenge at Food Factory

- Ethylene speeds up the decomposition process
- Mold and fungus, crucial in packaging and storage areas
- Bacteria and viruses most common from humans
- Cooling room and freezing room is not possible to clean
- Staff awareness and hygiene
- Dust on products during storage concerns the consumer

Bioaerosols in Food Factory

- Uncontrolled factors (processes, personnel, structures, etc.) contribute to the release of microorganisms in indoor environments
- Bacteria, virus, mold and pollen



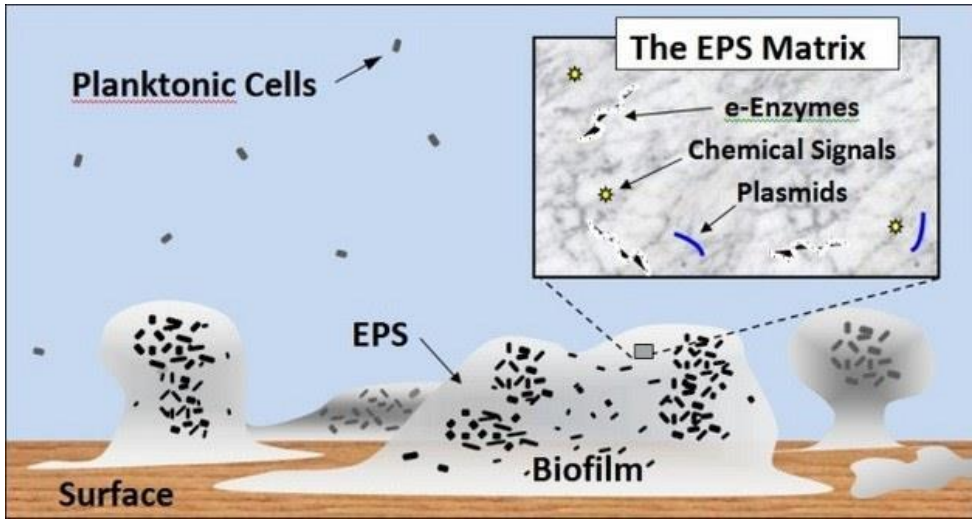
Air in food products facilities is a vector of contamination

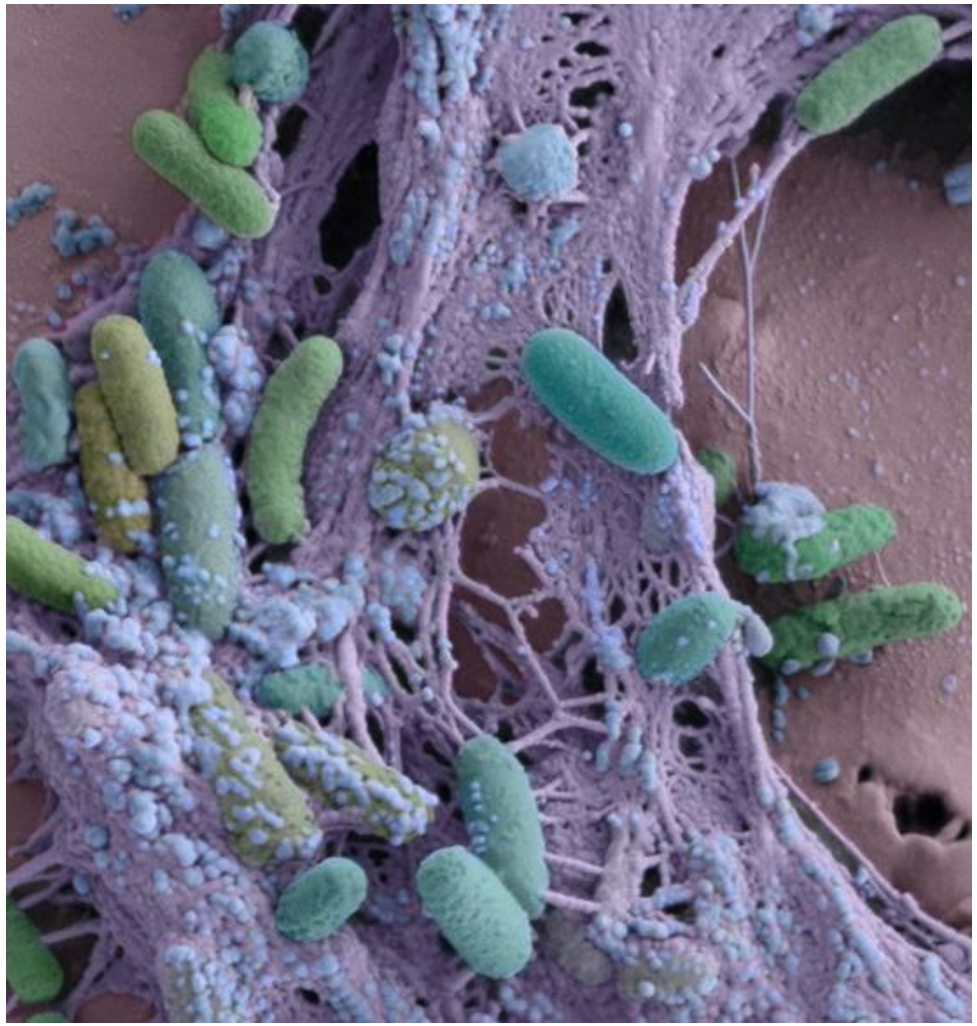
Contaminants can be dispersed by aerosols consisting of solid (e.g. dust) or liquid (e.g. condensation water) microscopic particles dispersed in air. These particles may carry microorganisms (bioaerosols) such as pathogenic bacteria or fungi or even viruses, spores or allergenic substances.

Air Movement Challenges at Food Factory

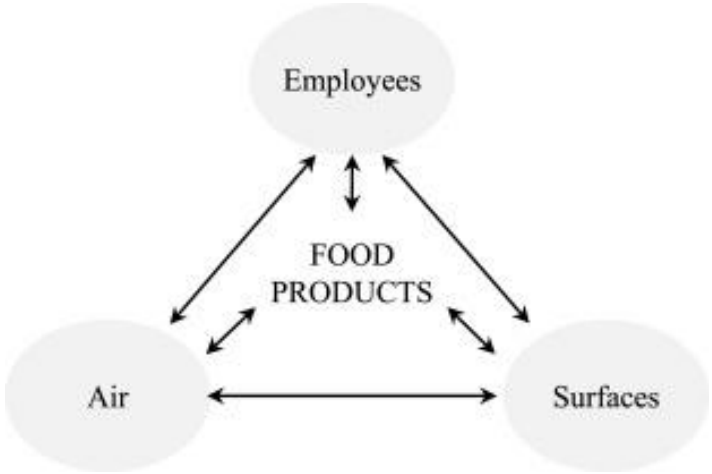
- Air change requirements are built around the original lay out of first design at establishment
- Addition of new product lines, employees – neglecting air change requirement
- Current HVAC Capacity is at the limit
- Identification of mold and moisture build up

Biofilm as Favorable Microorganism Growth Promoter in Ductwork





Air Quality Problem Case: Cross Contamination in food industry



BREAD MANUFACTURING COMPANY

AREAS OF CONCERN:

- Claims due to mould on product before expiring date

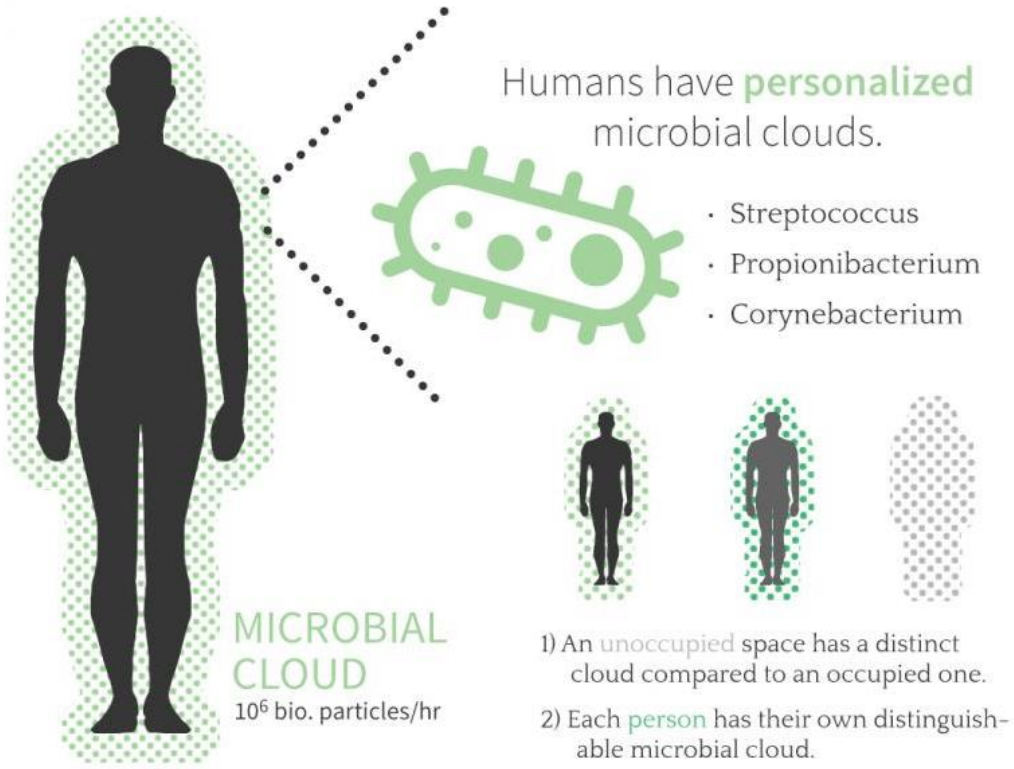
IDENTIFIED CONTAMINATION SOURCES

- No air filtration in the production and packaging area
- Same air quality in production as in shipping areas
- The packed bread production is an "open circuit" and exposed to ambient air
- Air quality improvement needed

Case description from Camfill Air Filter

Main Indoor Contaminants - Human

Microbial cloud: 10.000.000 particles/minute



https://peerj.com/articles/1258/

Possible Contaminants in Food Factory

Ecoli
Paracetic Acid – PAA (disinfectant)
Bacterias
VOC – Volatile Organic Compounds
Product Ingredients – Cross contamination
Ozone

Poly Vinyl Chloride
Mercury
Ethylene Oxide
Human generated particle cloud
Particle generated indoors and outdoors

Employee Health Situation

Figure 1. Number of reported clusters of COVID-19 in different occupational settings March–July 2020 (based on individual and aggregate data reported by 13 EU/EEA countries and the UK) (n=1 266)

Note: Clusters in 'other' occupational settings (n=79 clusters) and unclassified settings (n=63) are not included.

The date of the identification of the cluster was available for 264 clusters reported by nine countries (Cyprus, Czechia, Finland, France, Latvia, Lithuania, Malta, the Netherlands and Romania), however 49 of these clusters

[COVID-19 clusters and outbreaks in occupational settings in the EU/EEA and the UK (europa.eu)]

STERIONIZER™

Ethylene Release From Fruits & Vegetables Speeds Up Decomposition of other Ethylene sensitive Fruits

Sterionizer Improves Indoor Air Quality

Target of Improved Indoor Air Quality with Sterionizer

REDUCTION OF CROSS CONTAMINATION

IMPROVEMENT OF PRODUCT SHELF LIFE

PROTECTION OF EMPLOYEE HEALTH

REDUCTION OF MOULD LEVELS

The Sterionizer™ uses the *Nature Way* to clean the air

Ion emission

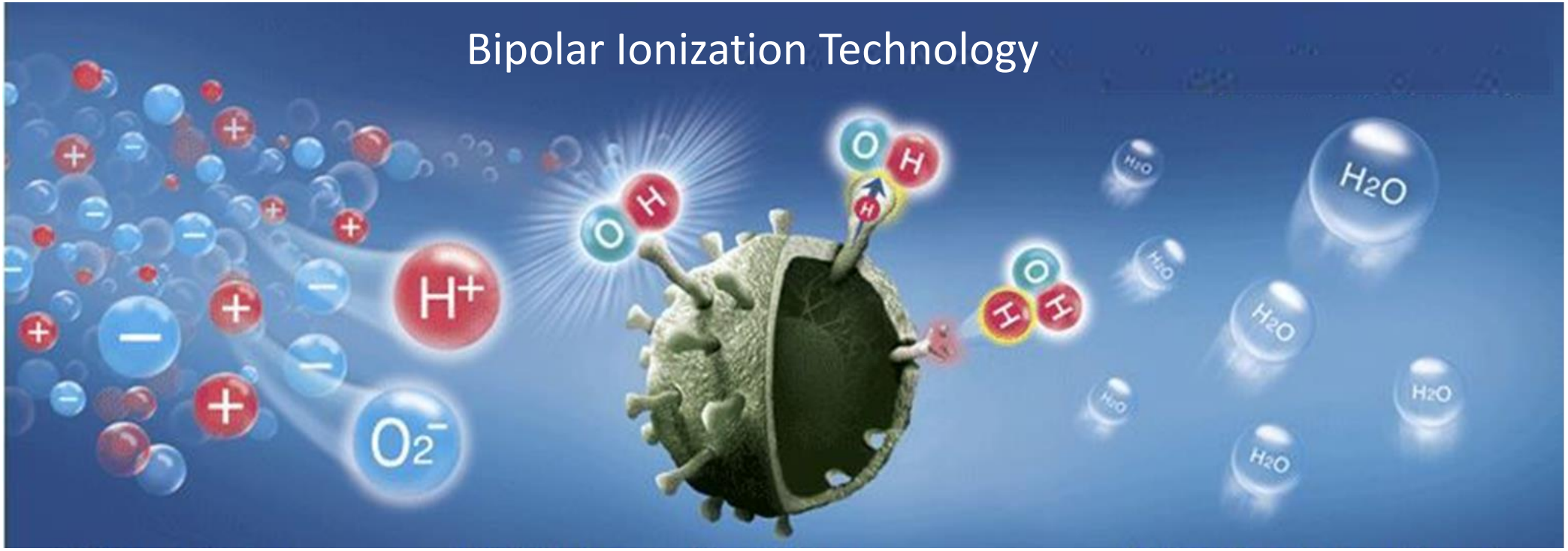
The Sterionizer™ uses a corona discharge system to charge oxygen molecules into O_2^+ and O_2^- molecules.

Breakdown the microorganism

Only when ions come into contact with the surface of a mold spore,bacteria or virus do they transform into OH radicals.The OH radicals instantly steal hydrogen (H) from the proteins on the bacteria surface, breaking down the proteins

Ions turn into water

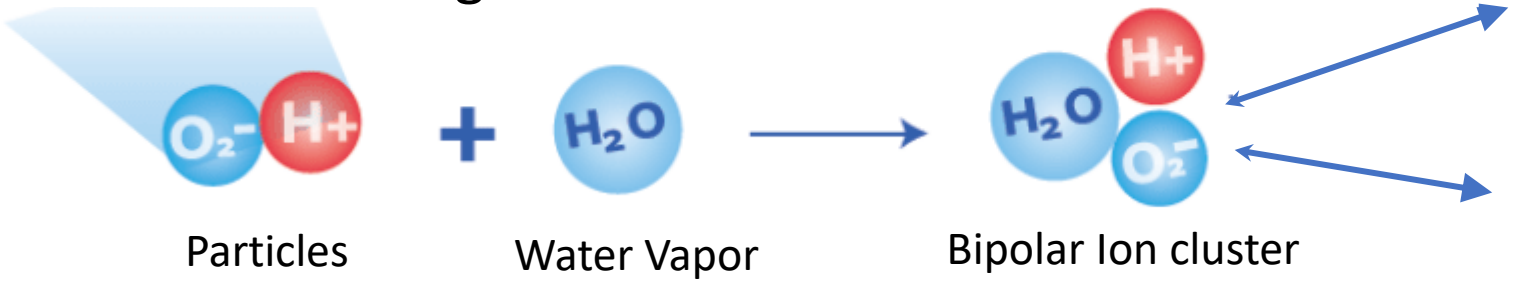
The combining of an OH radical with hydrogen (H) creates water (H2O) which return to the air.



The Sterionizer™ Neutralizes VOC gas & Odor

Bipolar Ionization Technology

Sterionizer generates and emits the same positive and negative ions like in nature



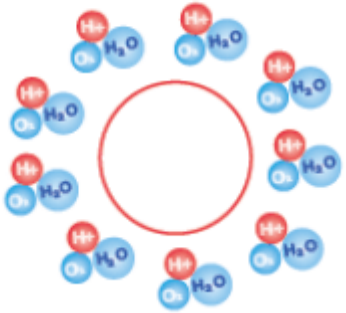
Particles

Water Vapor

Bipolar Ion cluster

Generates Clean Indoor Air

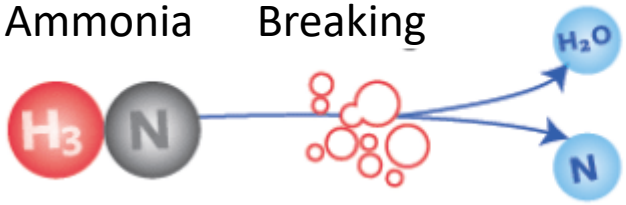
Bipolar Ions surround the VOC gasses



It breaks toxic gases and produce harmless gases

Ammonia

Breaking



Water

Nitrogen

STERIONIZER™

The Sterionizer™ breakdowns Ethylene & Molds

Food item	Refrigerator without the Sterionizer™	Refrigerator with the Sterionizer™
Tomatoes without a plastic bag	Advanced fustiness	First signs of fustiness, item relatively fresh
Cucumbers in a plastic bag	Advanced fustiness, molds	Fresh
Yellow cheese	Clear signs of molds, dry	No signs of molds, dry
Cup of milk	Yellow/Brown color, bad smell "muddy" texture	Normal color, normal smell, pellicles (natural)
Cherries	Advanced fustiness in most items	Only first signs of fustiness in some items. Most fruits are fresh.

STERIONIZER™

The Sterionizer™ slows Decomposition Process

- Limitation of Bacterial Growth
- Neutralization of Ethylene gas
- Longer shelf time

2 WEEK





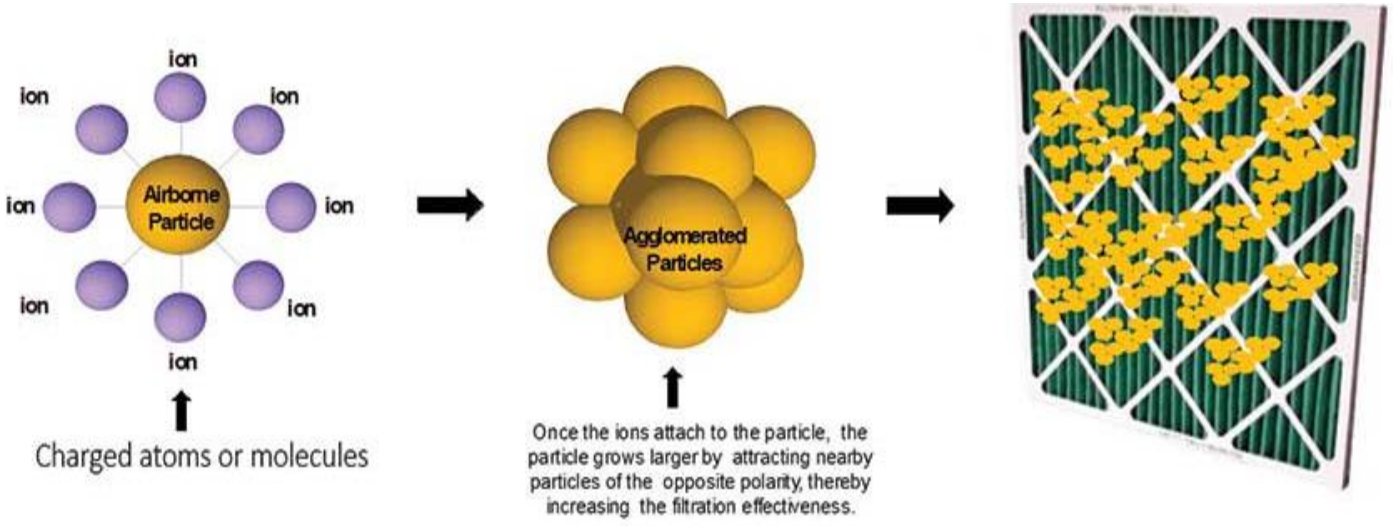



Test without Sterionizer: 2 weeks test in refrigeration

Test **with** Bi-polar Ionizer: 2 weeks test in refrigeration

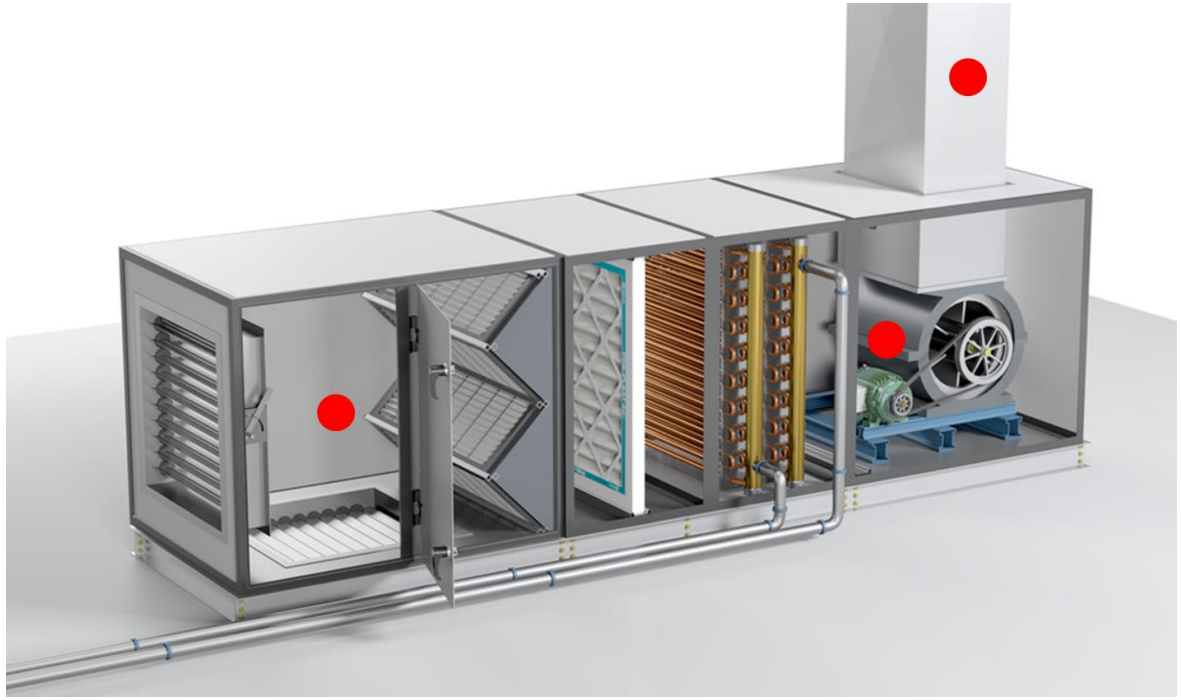
The Sterionizer™ agglomerates very small particles

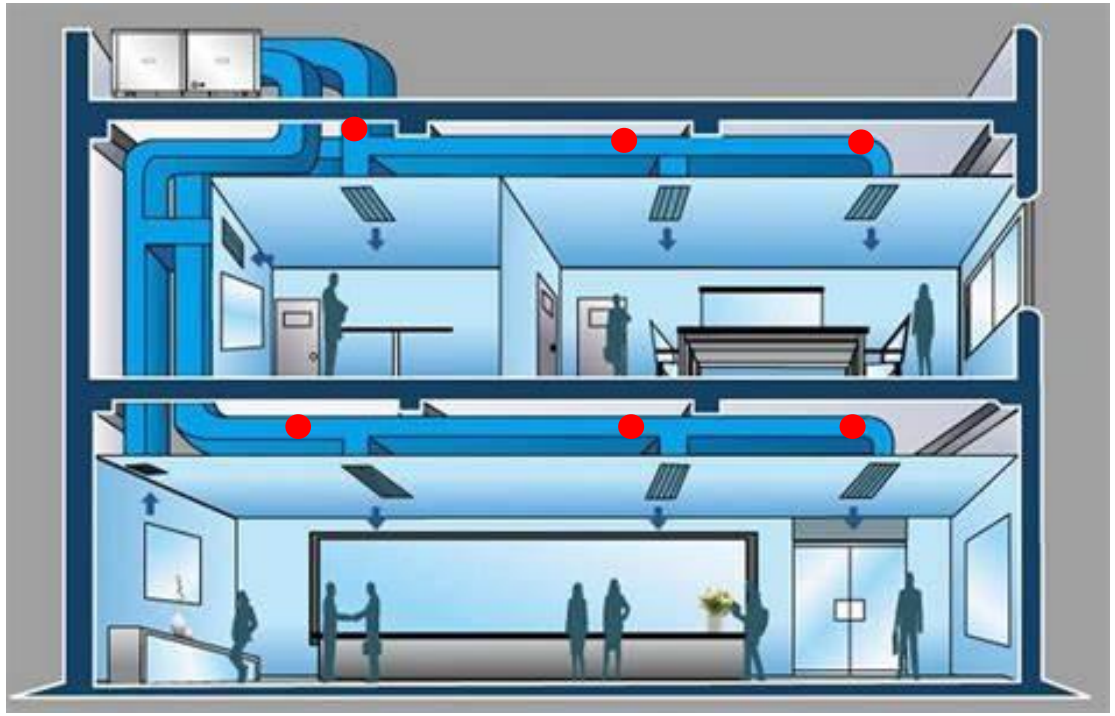
Charged very small particles are increasingly attracted and joined to one another, their size and weight is increased to the point where they are large and heavy enough to be moved with the HVAC system's air movement.



- **Air filters become more efficient at removing very small particles**
- **Opportunity to reduce air change rate - green energy saving**
- **Ductwork stays clean**

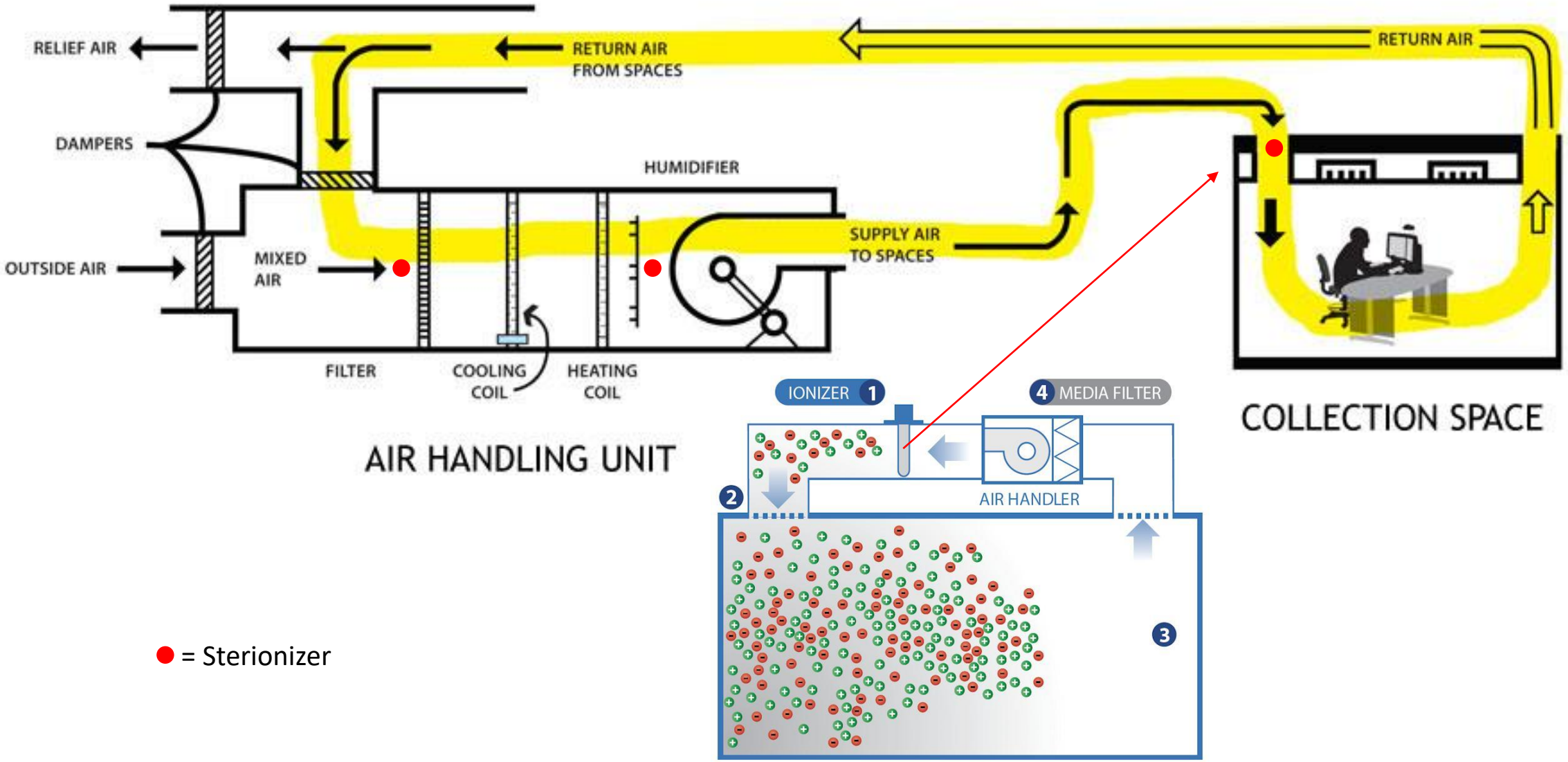
Installation of Sterionizer in Air Handling System





STERIONIZER™

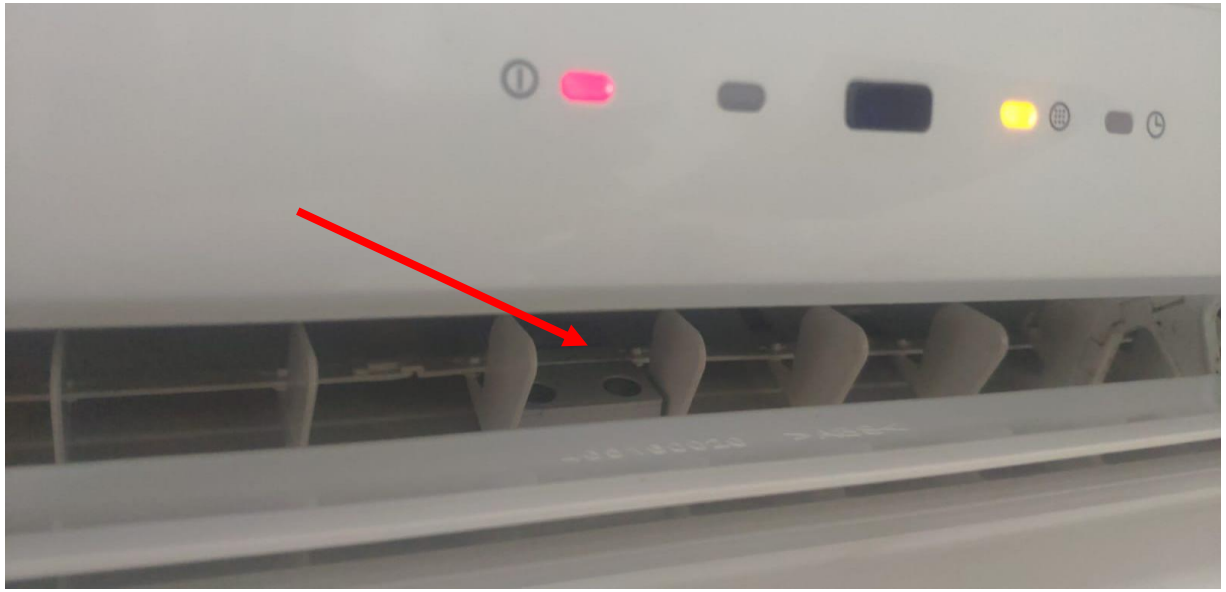
Installation of Sterionizer in Air Handling System

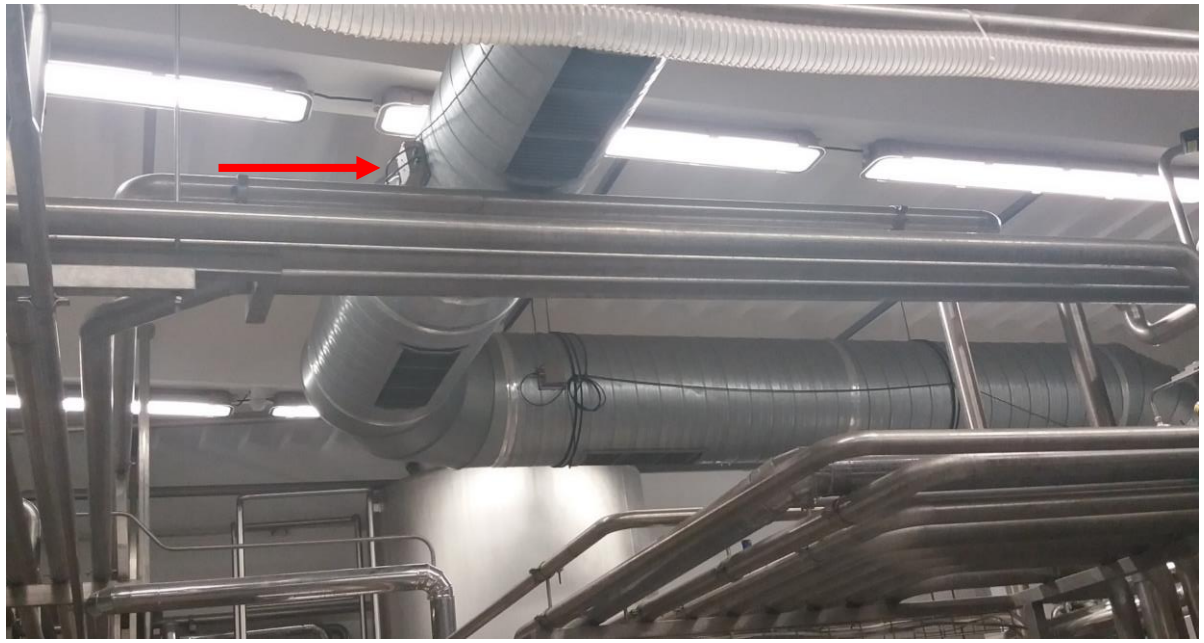


● = Sterionizer


Air Flow


DYNAIR
R134A





STERIONIZER™

Tekonologi Ion Bipolar - Bebas Ozon – O3

Sterionizer telah diuji sesuai test UL 867 dan standar UL 2998 sebagai bebas ozon

Underwriters Laboratories

Validasi Bebas Ozon UL 2998

The power output is controlled to less than 12.07eV to prevent the formation of ozone.
Sterionizer's NPBI technology has been certified by UL 867 and UL 2998 as an ozone free technology.
It does not emit more than 0.005 ppm ozone

Proven Technology

STERIONIZER™

Efficacy Tests carried out with research organizations

Substance	Substance Name	Testing Organization	Removal	Year
Bacteria	Escherichia Coli	EMSL Analytical, USA	99%	2011
	Escherichia Coli ATCC	Istanbul University, Turkey	91%	2011
	Staphylococcus aureus	EMSL Analytical, USA	81%	2011
	Pseudomonas aeruginosa	Istanbul University, Turkey	99%	2011
	Staphylococcus aureus (MRSA)	EMSL Analytical, USA	99%	2013
Fungus	Aspergillus Niger	EMSL Analytical, USA	97%	2011
	Candida albicans	EMSL Analytical, USA	97%	2011
	Dichobotrys abundans	Prof. Joe F. Boatman, USA	90%	2006
	Penicillium	Prof. Joe F. Boatman, USA	95%	2006
Mold	Cladosporium cladosporioides	EMSL Analytical, USA	36 %	2011
Spores	Bacillus subtilis var niger	Istanbul University, Turkey	89%	2011
Viruses	Influenza H1N1	Kitasato Research Center, Japan	99%	2011
	Influenza H5N1	Kasetsart University, Thailand	99%	2011
	Influenza SARS-CoV-2, aerosolized	Innovative Bioanalysis	99%	2021
	Influenza SARS-CoV-2, surface	Innovative Bioanalysis	99%	2021

Efficacy Report

Against surface SARS-Cov 2

INNOVATIVE BIOANALYSIS
creating solutions | getting results

Efficacy Study Summary of the D6 STERIONZER™ against surface SARS-CoV-2

Project	Filt Air Ltd. D6 Sterionizer™ Surface SARS-CoV-2
Product	D6 STERIONIZER™ BIPOLAR NEEDLEPOINT IONIZER
Laboratory Project #	1047
Testing Facility	Innovative Bioanalysis, Inc
Study Dates	04/06/2021 – 06/10/2021
GLP Compliance	All internal SOPs and processes follow GCLP guidelines and recommendations.
Test Substance	SARS-CoV-2 USA-CA1/2020
Description	Filt Air Ltd. provided a D6 STERIONIZER™, a compact bipolar needlepoint-ionizing device designed to be integrated into an air movement system such as an HVAC duct system, air conditioner or humidifier. The in vitro study evaluates the efficacy of the D6 STERIONIZER™ against SARS-CoV-2 on surfaces.
Test Conditions	The study conducted two control tests and 3 viral challenges in a certified Biosafety hood inside a BSL-3 laboratory. The temperature during testing was approximately 73 ±2°F, with a relative humidity of 44%. Slide samples were collected after 0, 15 and 30-minute exposure to the operating device.
Test Results	Active SARS-CoV-2 concentrations on the sample surfaces were reduced at the 15-minute and 30-minute time point. After 15 minutes of operation, the trial observed a decrease in the initial viral concentration of 6.32×10^6 to an average of 9.61×10^5 TCID50/ml and after 30 minutes to an average of 6.53×10^3 TCID50/ml.

Exposure Time	*Reduction in %*
15 minutes	84.80
30 minutes	99.90

Conclusion	The Filt Air Ltd. D6 STERIONIZER™ demonstrated the ability to reduce the concentration of the active pathogen SARS-CoV-2 on surfaces when exposed to a negative and positive ion concentration.

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9/7/2021

Kevin Noble — **Date**
Laboratory Director, Innovative Bioanalysis, Inc.

Against aerosolized SARS-Cov 2

INNOVATIVE BIOANALYSIS
creating solutions | getting results

Efficacy Study Summary of the D6 STERIONZER™ against aerosolized SARS-CoV-2

Project	Filt Air Ltd. D6 Sterionizer™ Aerosol SARS-CoV-2
Product	D6 STERIONIZER™ BIPOLAR NEEDLEPOINT IONIZER
Laboratory Project #	1047
Testing Facility	Innovative Bioanalysis, Inc
Study Dates	04/12/2021 – 08/03/2021
GLP Compliance	All internal SOPs and processes follow GCLP guidelines and recommendations.
Test Substance	SARS-CoV-2 USA-CA1/2020
Description	Filt Air Ltd. provided a D6 STERIONIZER™, a compact bipolar needlepoint-ionizing device designed to be integrated into an air movement system such as an HVAC duct system, air conditioner or humidifier. The in vitro study evaluates the efficacy of the D6 STERIONIZER™ against aerosolized SARS-CoV-2.
Test Conditions	The study conducted two control tests and 3 viral challenges in a certified Biosafety hood inside a BSL-3 laboratory. The temperature during testing was approximately 73 ±2°F, with a relative humidity of 44%. Air samples were collected after 0, 15 and 30-minute exposure to the operating device.
Test Results	Active SARS-CoV-2 concentrations were observed to have been significantly reduced at the 15-minute and 30-minute time point. After 15 minutes of operation, the trial observed a decrease in the initial viral concentration of 7.02×10^6 to an average of 2.97×10^6 TCID50/ml and after 30 minutes to an average of 8.86×10^4 TCID50/ml.

Exposure Time	*Reduction in %*
15 minutes	57.71
30 minutes	98.74

Conclusion	The Filt Air Ltd. D6 STERIONIZER™ demonstrated the ability to reduce the concentration of aerosolized SARS-CoV-2 when exposed to a negative and positive ion concentration.

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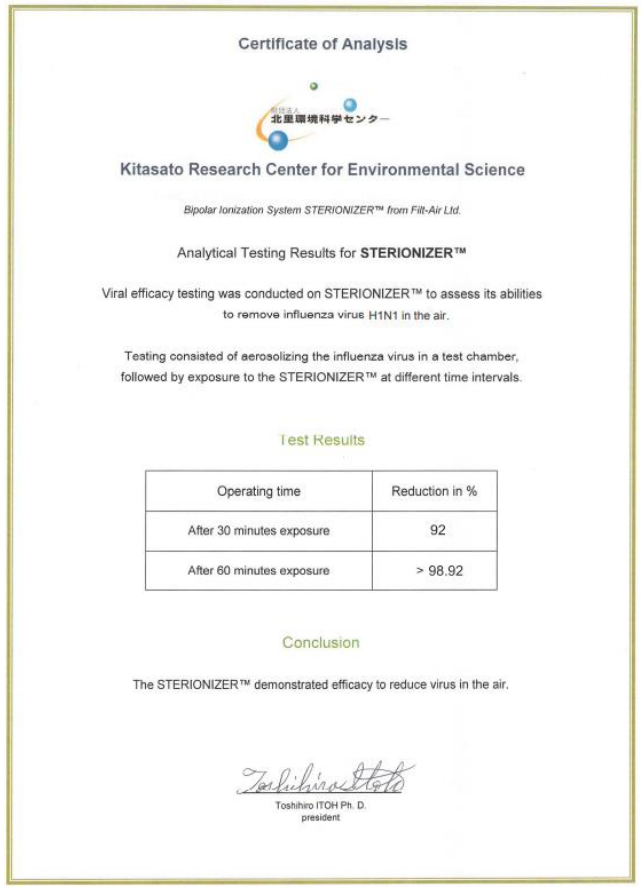
9/7/2021

Kevin Noble — **Date**
Laboratory Director, Innovative Bioanalysis, Inc.

Certificate Analysis



Certificate of Analysis

北里環境科学センター

Kitasato Research Center for Environmental Science

Bipolar Ionization System STERIONIZER™ from Filt-Air Ltd.

Analytical Testing Results for **STERIONIZER™**

Viral efficacy testing was conducted on STERIONIZER™ to assess its abilities to remove influenza virus H1N1 in the air.

Testing consisted of aerosolizing the influenza virus in a test chamber, followed by exposure to the STERIONIZER™ at different time intervals.

Test Results

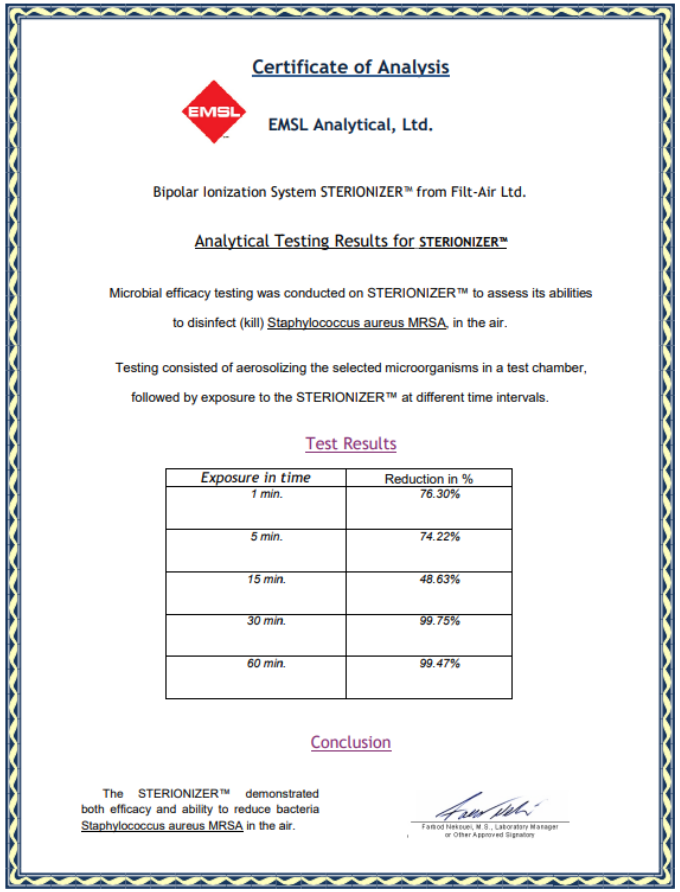
Operating time	Reduction in %
After 30 minutes exposure	92
After 60 minutes exposure	> 98.92

Conclusion

The STERIONIZER™ demonstrated efficacy to reduce virus in the air.

Toshihiro ITOH Ph. D.
president

Influenza Virus H1N1 99.47%



Certificate of Analysis

EMSL Analytical, Ltd.

Bipolar Ionization System STERIONIZER™ from Filt-Air Ltd.

Analytical Testing Results for STERIONIZER™

Microbial efficacy testing was conducted on STERIONIZER™ to assess its abilities to disinfect (kill) Staphylococcus aureus MRSA in the air.

Testing consisted of aerosolizing the selected microorganisms in a test chamber, followed by exposure to the STERIONIZER™ at different time intervals.

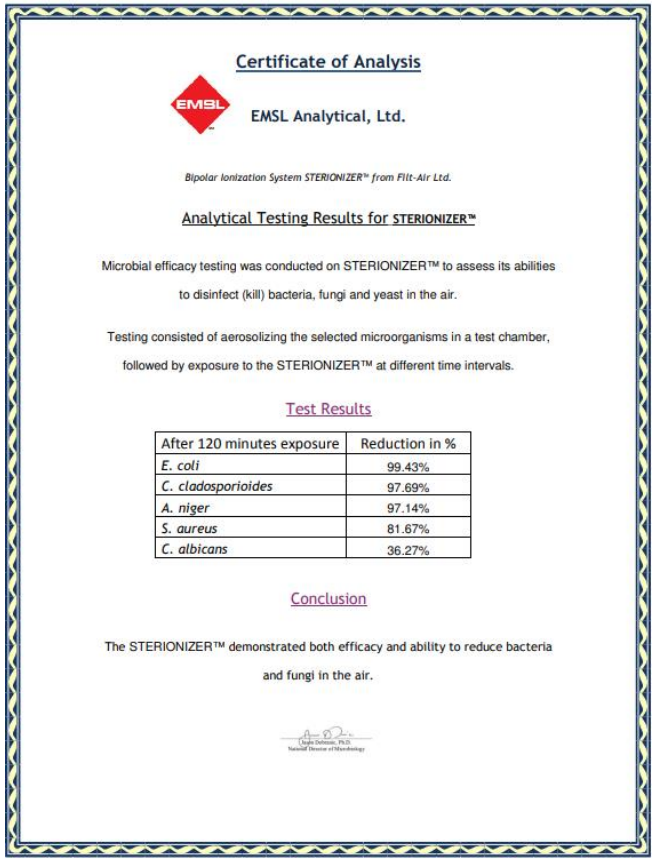
Test Results

Exposure in time	Reduction in %
1 min.	*76.30%*
5 min.	*74.22%*
15 min.	*48.63%*
30 min.	*99.75%*
60 min.	*99.47%*

Conclusion

The STERIONIZER™ demonstrated both efficacy and ability to reduce bacteria Staphylococcus aureus MRSA in the air.

Staphylococcus aureus MRSA 99.47%



Certificate of Analysis

EMSL Analytical, Ltd.

Bipolar Ionization System STERIONIZER™ from Filt-Air Ltd.

Analytical Testing Results for STERIONIZER™

Microbial efficacy testing was conducted on STERIONIZER™ to assess its abilities to disinfect (kill) bacteria, fungi and yeast in the air.

Testing consisted of aerosolizing the selected microorganisms in a test chamber, followed by exposure to the STERIONIZER™ at different time intervals.

Test Results

After 120 minutes exposure	Reduction in %
E. coli	99.43%
C. cladosporioides	97.69%
A. niger	97.14%
S. aureus	81.67%
C. albicans	36.27%

Conclusion

The STERIONIZER™ demonstrated both efficacy and ability to reduce bacteria and fungi in the air.

E. coli 99.43%
C. cladosporioides 97.69%
A. niger 97.14%
S. aureus 81.67%
C. Albicans 36.27%

Sterionizer™ D5 Series

Ion output	10^{10} ion/sec
Ion balance	Self-balancing
Ozone	<0.005 ppm (according to UL2998)
Input voltage / current	12 V DC ±10%, 30mA average
Power supply requirement	12 V DC – 300mA
Required airflow	> 0.3 m/s laminar
Operating environment	Temp. -10°C - 70°C RH < 93% non-condensing
Enclosure	Polycarbonate-ABS blend
Dimensions	50 x 40 x 12 mm
Certifications	EMC, CE, UL, RoHS 2 compliant

Sterionizer™ D6 Series

Building Automation Ready

Ion output	≤ 10^{12} Ion/sec
Emitter cleaning	Self-cleaning – maintenance free
Emitter Points	Tungsten
Input voltage	12V AC/DC ± 10%, 200 mA, isolated / 24V AC/DC ± 10%, 200 mA, isolated
Operating environment	Temp. (-10)-(+70)°C, Hum. 20-93% non-condensing
Ambient Airflow	Minimum 0.3 m/sec laminar
Ozone	< 0.005 ppm (according to UL2998)
EMI	Below background levels (rec. 80mm distance)
LED indicator	green: power "on" - orange: "operation"
Connector power	12/24 V - 0 - ground
Connector output	On/Off ; optional I/O ; optional I/O ; optional dry contact; common
Connector interface	RS485 Modbus (up to 247 units)
Enclosure	PC-ABS plastic blend, color grey (black)
Dimensions	96 x 74 x 24.5 mm (L x W x H)
Dimensions mounting	107 x 89 x 24.5mm with bracket and connector
Weight	146 gram
Certifications	EMC, CE, UL, RoHS 2 compliant

D6 Combination for various installation case

Tube unit type

Duct unit type

Ion bar type

Combi rack type