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Air Disinfection Biosecurity *(ADB)*

A modulated dielectric barrier discharge cold plasma air treatment technology

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A Review Of

Air Disinfection Biosecurity (ADB)

A modulated dielectric barrier discharge cold plasma air treatment technology

Disease-causing bacteria, viruses, and fungi, as well as overall bioburden, odors, and volatile organic compounds (VOCs) often compromise a facility's indoor air quality profile.

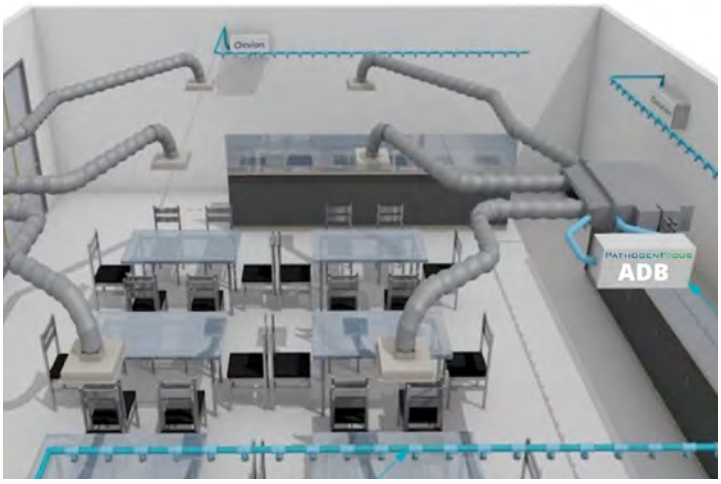
Filtration and ventilation are beneficial, but they can't destroy aerosolized pathogens in the breathing zone or microbial contamination on surfaces.

ADB is fully validated for safety and efficacy and has been improving and protecting indoor air for over 25 years in over 20,000 installations worldwide.

THE ORIGINS OF ADB

ADB technology was originally developed over 25 years ago by IPAM/Oxyion to mitigate fungus, bacteria, viruses, and ethylene; protecting as well as extending the shelf life of perishables in agribusiness and food processing.

Today, ADB provides biosecurity to over 20,000 installations in 13 countries serving a variety of industries including, but not limited to, healthcare, food processing, indoor work spaces, agribusiness, retail, and transportation.



PathogenFocus, under agreement with Oxyion, now manufactures and sells systems as "ADB" in the USA at their EPA-registered facility in Henderson, NC. With a skilled team of engineers, scientists, and customer service specialists, PathogenFocus is uniquely equipped to tailor and support air purification and biosecurity systems for a variety of industrial, municipal, and commercial needs across the US and beyond.

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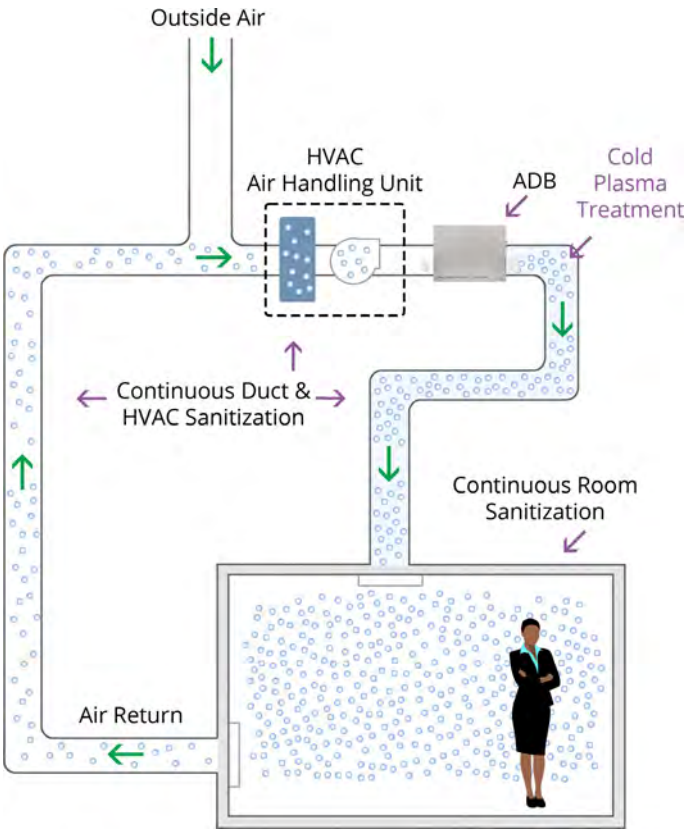
A LOOK UNDER THE HOOD

The ADB system is a proprietary Modulated Dielectric Barrier Discharge (MDBD) technology creating non-thermal (cold) plasma air treatment. ADB technology is differentiated from other non-thermal plasma technologies by its ability to generate highly consistent plasma capable of prolonged, self-sustaining propagation, making disinfecting agents available to neutralize harmful microbes in the air and on surfaces. Systems are engineered for their designated indoor environment application, based on each facilities interior cubic ft and airflow (CFM).

ADB systems generate a specific non-thermal plasma from ambient air with several reactive sub-compounds of oxygen and peroxides including gas-phase hydrogen peroxide (well below regulatory emissions thresholds) and trace amounts of ozone (also well below all regulatory thresholds). These oxygen species are highly reactive molecules and collectively and actively eliminate airborne and surface-level microorganisms.

BENEFITS

- Highly Effective Microbial Control
- Additional Voc And Odor Control
- Safe For Use Around People, Animals, And Plants
- Fully Automated And Ubiquitous
- Low Maintenance
- No Disruption To Daily Operations
- Disinfects Without Adding Staff Hours
- No Chemicals, Residue
- No Consumables Required
- Custom-Tailored, Scalable Solutions
- Low Energy Consumption (.01 - .03 Watts/Sq Ft)
- IoT Control Monitoring Available
- Seamlessly Integrated, Powerful Enhancement to All Current Anti-Microbial Protocols



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TESTIMONIALS

Mark H. Ereth | MD, Emeritus Professor, Mayo Clinic College of Medicine and Science

"After an extensive review of over 40 research studies, it appears that PathogenFocus ADB technology's near instantaneous inactivation of pathogens in breathing-zone air, and the corresponding significant reduction in bioburden make this technology an innovative and important part of infection prevention."

Sherif Assal | President and COO of American Guard Services

"After reviewing alternative technologies, it was clear to us that this technology provided the overall best level of protection to our staff and customers in our ongoing efforts to provide a clean and safe work environment in the face of ongoing concerns of Covid."

Sergio Olano | Quality Assurance Manager. Valley Select Foods, Inc.

"Our commitment to Food Safety and Workers' Health made us decide to pursue this type of technology that has been effective in our workers' areas and processing operations, giving us the confidence that our company is always providing a Food Safe product to the marketplace, and at the same time providing the safety measures on preventing the presence or growth of pathogens in the workplace, becoming an effective biosecurity control system."

Innovation of the Year Award Honoree

ISSA SHOW NORTH AMERICA 2023

NOVEMBER 13 - 16 | LAS VEGAS, NV

2022 retrofit TOP 25 PRODUCTS

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Technology Comparison

Bacterial and Viral Reductions on Surfaces and in Air Over Time

Bacterial study used enterococcus faecium, an acceptable non-pathogenic surrogate for Clostridium sordellii, Influenza A, MRSA, Staphylococcus aureus, Klebsiella pneumonia, and Pseudomonas aeruginosa. Viral study used The F-9 strain of Feline Calicivirus, an approved surrogate for SARS-CoV-2)

SCIENTIFIC VALIDATION & EFFICACY

The efficacy of ADB technology is validated by international studies conducted by Food Safety & Process Technology, Scientific Air Solutions, Kansas State University Food Science Institute, USDA Agricultural Research Service and Food Safety Laboratory in the USA; Cesmec (Chile), Ch. University (Chile), PUC (Chile), Ainia (Spain), Tecnalia (Spain), SGS (Intl.), Intertek (Intl.), and the Certification of the European Community (EU).

The ADB process is approved by USDA National Organic Program as a chemical free sanitizer/ disinfectant. Additionally, the technology has been approved and registered for use in organic products with the EU Organic Program. A peer-reviewed study by USDA Food Safety Laboratory concludes, "reduction of airborne microorganisms using the non-thermal plasma generating system" appeared "more efficient than those reported with other approaches, such as electrostatic precipitation and germicidal (UV) air purification console units."

A 2021 study by Scientific Air Solutions found ADB faster and more effective against air and surface bacteria and virus, outperforming Bipolar ionization (BPI), Photocatalytic oxidation (PCO), and a UV-C germicidal air box (UV-C).

SURFACE
Log/Percent **CFUcm2**

	Bacteria (**30 minutes**) *Log Reduction / %*	Virus (**15 minutes**) *Log Reduction / %*
ADB	MDBD **7.89** / *99.99998%*	MDBD **7.70** / *99.99998%*
BPI-1	bipolar ionization **0.54** / *71.15385%*	bipolar ionization **0.42** / *62.00000%*
BP1-2	bipolar ionization **0.40** / *60.25641%*	bipolar ionization **0.15** / *30.00000%*
PCO	photocatalytic oxidation **0.44** / *23.07692%*	photocatalytic oxidation **0.24** / *58.00000%*
UV-C	UV Germicidal air chamber **0.04** / *8.33333%*	UV Germicidal air chamber **0.15** / *29.00000%*

AIR
Log/Percent **CFUcm3**

	Bacteria (**2 minutes**) *Log Reduction / %*	Virus (**1 minute**) *Log Reduction / %*
ADB	**7.82** / *99.99998*	**7.74** / *99.99998*
BPI-1	**0.19** / *34.35115*	**0.02** / *4.90909*
BP1-2	**0.32** / *52.21374*	**0.12** / *23.94000*
PCO	**0.06** / *13.23206*	**0.05** / *11.54555*
UV-C	**0.06** / *12.21374*	**0.03** / *6.96909*

HEALTHCARE-ACQUIRED INFECTIONS

INFLUENZA, NOROVIRUS

Additional efficacy studies show excellent performance against Healthcare-acquired infections (HAIs) including but not limited to Candida auris, Methicillin-resistant Staphylococcus aureus (MRSA), Pseudomonas aeruginosa, Clostridioides difficile, and Escherichia coli. Efficacy against Influenza A (H1N1) and Norovirus has also been documented. (Available upon request)

ACADEMIC RESEARCH

A substantial and global body of academic research is currently heralding the efficacy and safety of DBD NTP for use in a broad variety of applications including indoor air quality and purification[1], inactivation of enveloped and non-enveloped viruses including SARSCoV-2[2], sterilization of medical devices[3], food preservation[4], maintaining the quality and freshness of produce[5], efficacy against prions[6], and more.

SAFETY

PathogenFocus ADB units have been evaluated for safety by Intertek, Eurofins, BlueHeaven Technologies, and Scientific Air Solutions and found to create zero harmful byproducts and produce only trace amounts of ozone well under the limits set by UL867, the US Environmental Protection Agency (EPA), California Air Resources Board (CARB), the Food and Drug Administration (FDA), and the Occupational Safety and Health Administration (OSHA), among others. Our ADB units also meet the UL#2998 requirement for ozone safety. Certifications also include CE (European Communion electrical safety), and TÜV SÜD. PathogenFocus is a U.S. Environmental Protection Agency (EPA) registered establishment, and ADB is registered by USDA National Organic Standards for use as a sanitizer/ pesticide without restrictions.

CONCLUSION

Dielectric Barrier Discharge Nonthermal plasma treatment for improved air quality and microbial control is well validated and measured. PathogenFocus is proud to bring this proprietary modulated dielectric barrier discharge technology to market with a high quality product (ADB) and support team to partner with you for cleaner, safer environments.

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