Performance Report - E.Coli

GPS NPBI

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OVERVIEW

Through our patented technology, needlepoint bipolar ionization, also known as NPBI™, our products clean indoor air by reducing airborne particulates, odors and pathogens — all while saving you energy consumption and lowering your carbon footprint. GPS delivers cleaner indoor air without producing ozone or other harmful byproducts. GPS is proud to lead the market by being the safe, effective choice for ionization and we have the results to prove it.

PERFORMANCE VALIDATION

GPS has long been a leader in the indoor air quality systems market, providing technology that is based on reliable science and an unwavering obligation to the safety of our customers and communities. We realize that a testing approach is as important as the results themselves and live this philosophy with robust testing methodologies and capabilities.

SENSITIVITY TESTING

A petri dish containing a pathogen is placed underneath a laboratory hood, then monitored to assess the pathogen's reactivity to NPBI over time. This controlled environment allows for comparison across different types of pathogens. Sensitivity Testing is not a measure of pathogen inactivation in the air.

SIMULATION TESTING

Simulation testing measures in-air inactivation of pathogens. Counts of an airborne pathogen are taken before and after aerosolizing that pathogen into a sealed, unoccupied laboratory environmental room installed with NPBI technology.

SPECIALTY TESTING

Unoccupied laboratory test environments are designed to evaluate NPBI performance in conditions unique to particular industries or customers, and may include special circumstances such as higher than average ion concentrations. Review individual test results for details.

FIELD TESTING

Unoccupied laboratory test environments are designed to evaluate NPBI performance in conditions unique to particular industries or customers, and may include special circumstances such as higher than average ion concentrations.

DISCLAIMER: Global Plasma Solutions (GPS) uses multiple data points to formulate performance validation statements. GPS technology is used in a wide range of applications across diverse environmental conditions. Since locations will vary, clients should evaluate their individual application and environmental conditions when making an assessment regarding the technology's potential benefits.

The use of this technology is not intended to take the place of reasonable precautions to prevent the transmission of pathogens. It is important to comply with all applicable public health laws and guidelines issued by federal, state, and local governments and health authorities as well as official guidance published by the Centers for Disease Control and Prevention (CDC), including but not limited to social distancing, hand hygiene, cough etiquette, and the use of face masks.

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Benefits of GPS

TECHNOLOGY

A PROVEN PROCESS TO CLEAN THE AIR

TARGETS PARTICLES

When these ions disperse throughout a space, such as an office or a schoolroom, they combine with particles suspended in the air. This creates a snowball effect in which particles of opposite polarities begin to cluster together, making them easier to capture in filtration systems.

REDUCES PATHOGENS

During the NPBI process, contact with ions disrupts pathogens' surface proteins, rendering them inactive and unable to replicate.

TACKLES ODORS

GPS' NPBI technology breaks down chemical, pet, cooking and other odors into basic harmless compounds, leaving indoor air smelling fresh and substantially reducing odor-causing VOCs.

SAVES ENERGY

By keeping indoor air cleaner, NPBI reduces the amount of air required from outside to keep things fresh — saving you initial ventilation equipment costs and up to 30% on energy consumption.

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Performance Reports

Q & A

We've compiled the following Q&A's to help improve understanding of our technology and its impact on air purification. To learn more, visit the GPS webpage on reducing airborne viruses.

Does this technology eliminate airborne pathogens entirely?
No, there is no way to guarantee ions will reach every virus or bacteria particle in the room. Viruses and bacteria that do not come into contact with ions will continue to be infectious and capable of spreading disease.

How does GPS protect people from pathogens?
GPS technology is not a medical device and is not marketed for disease prevention in people. Instead, GPS's NPBI is an air cleaning system intended to reduce the volume of infectious pathogens by inactivating them and improving the efficiency of filtration solutions.

Does the use of NPBI mitigate the need for social distancing, masks, etc.?
No, the use of this technology is not intended to take the place of reasonable precautions to prevent the transmission of pathogens. It is important to comply with all applicable public health laws and guidelines issued by federal, state and local governments and health authorities as well as official guidance published by the Centers for Disease Control and Prevention (CDC). This includes but is not limited to social distancing, hand hygiene, cough etiquette and the use of face masks.

How does GPS support performance statements regarding pathogens?
We engage independent laboratories to execute performance validation experiments.
COVID-19 has changed the way the world views indoor air quality. GPS is committed to leading through independent laboratory pathogen testing. GPS was the first in the industry to test our products against SARS-CoV-2 (COVID-19). GPS will continue to lead throughout the COVID-19 pandemic and beyond.

Does GPS create ozone? (Historically, ionization technology has been known to produce ozone.)
No, GPS is the safe and effective solution for air ionization. GPS offers UL 2998 certified products, which is the ASHRAE qualification standard for zero ozone emissions.

How does GPS differ from the rest of the air purification industry?
Not only does GPS improve indoor air quality without producing ozone or other harmful byproducts, but it is also the only auto-cleaning air purification system that ensures optimal long-term performance. Unlike alternative technologies, GPS' NPBI requires no replacement parts or future maintenance.

Please refer to the FAQ section of our site for additional details.
Please reach out to your GPS representative for additional information if needed.

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GPS-048-13-R1-MM

FINAL REPORT

Efficacy of a Bipolar Ionization System

ORDER Number
371106420

PREPARED FOR:

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Certificate of Analysis

Client: Global Plasma Solutions

Contact: Charles Waddell
Project: Bipolar Ionization System

Product : GPS-IBAR-36
EMSL NO: 371106420

Sample received: 5/25/2011
Start date: 6/7/2011
Report date: 7/21/2011
Challenge Bacteria: *Escherichia coli* ATCC 8739

Experimental Summary:

The testing procedure was designed after discussions between EMSL Analytical, the testing company, and the client, Global Plasma Solutions. The testing was conducted on the GPS-IBAR-36 for its ability to disinfect (kill) bacteria in the air. The testing was conducted in our Cinnaminson Microbiology Laboratory.

Procedure:

Bacteria

Escherichia coli (E. coli) was innoculated on Tryptic Soy agar (TSA) and incubated at 35°C for 24 h. A single isolated colony was then taken and innoculated into Tryptic Soy broth (TSB) and incubated at 35°C for 24 h. This solution was then washed three times with Phosphate buffer at 3,000 x g for 20 min. A one to ten dilution was then made by removing 1 mL of innoculated TSB and placing it into 9 mL of Phosphate buffer. One milliliter of this dilution was then placed into the base of the nebulizer and mixed with 99 mL of Phosphate buffer to create an additional 1:100 dilution.

Environmental Chamber

The environmental chamber was set-up as per the instructions included. One computer fan was placed in the center of the chamber to provide air movement and the two ionizers were placed on either side about 1 inch off the ground. Before testing began the entire chamber was disinfected with a disinfectant solution (5% Hydrogen peroxide with accompanying silver ionic solution), as well as cleaning the fans and ionizers with alcohol wipes. Additionally, between all testing the disinfectant solution was sprayed throughout the chamber and allowed to air out with the fans running for at least 2 hr.

Inoculation of the Test Chamber

The nebulizer was connected to an air compressor with ¼ inch plastic tubing and to the environmental test chamber through one of the testing openings created. The fan was turned on to create an air flow in the chamber but the ionizers were not turned on until after the initial sampling. Once testing was ready to begin 60 psi of compressed air was pumped through the nebulizer, creating the release of 10.8 mL/h of aerosolized solution. This was run for 28 min allowing for a total of 5 mL of solution being aerosolized into the test chamber.

Organism Collection

Immediately, following inoculation of the test chamber an initial collection of the bacteria was taken without the use of the bipolar ionizer. The bacteria were collected with an Anderson impactor at the sample time points 1 min (75 L), 5 min (100 L), 15 min (100 L), 30 min (150 L) and 60 min (200 L) in order to determine the natural rate of decay for *E. coli*. This data was then compared to the data collected when the ionizer was run to create a corrected Log Reduction. The test run was then completed identically the same with the exception that the bipolar ionizer was turned on. Bacteria were collected using TSAB plates and incubated at 35°C for 24 h. Afterwards, colonies were counted and statistics were performed on the data. All samples were completed in triplicate.

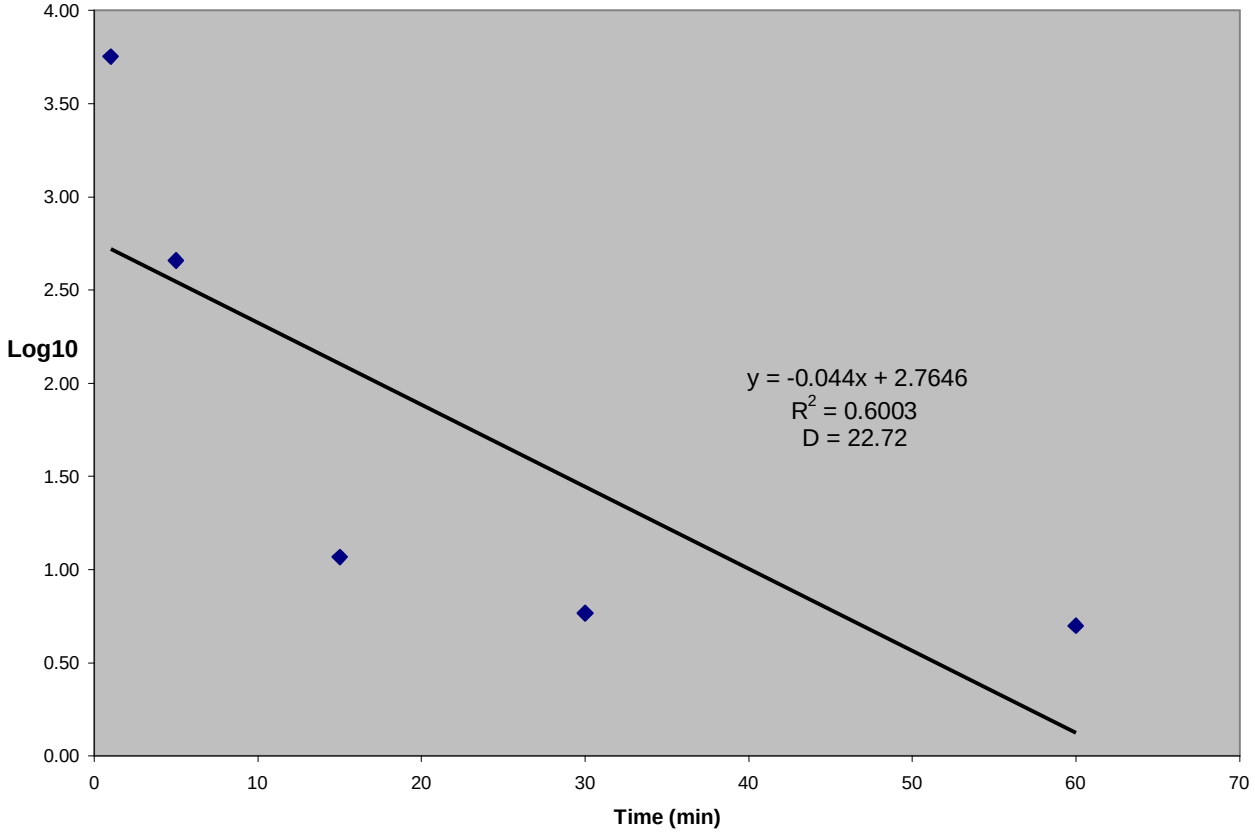
Experimental Results:

Table 1: Reduction of *E. coli*

***E. coli* Control**			***E. coli* Test**			
Time (min)	**CFU/m^3**	**Log10**	**CFU/m^3**	**Log10**	**Corrected LR**	**%Reduction**
1	6.50×10^3	3.81	5.65×10^3	3.75	0.06	13.03
5	6.27×10^3	3.80	4.55×10^2	2.66	1.08	91.65%
15	4.25×10^3	3.63	1.17×10^1	1.07	2.50	99.68%
30	1.47×10^3	3.17	5.83x10	0.77	2.34	99.54%
60	7.46×10^2	2.87	5.0x10	0.77	2.11	99.23%

Corrected LR = Log Reduction that has been compared to natural rate of decay for *E. coli*
Log Reduction and %Reduction compares initial CFU and specified CFU
A negative LR or %Reduction is the result of an increase in cells

Figure 1.1: Reduction of *E. coli*



D value = amount of time it takes for *E. coli* to be reduced by 1 log

Conclusions/Observations:

The efficacy of the GPS-IBAR-36, a bipolar ionization system, to disinfect the air of *E. coli* was analyzed. After correcting for the natural rate of decay it was observed that there was a 2.34 log reduction after 30 min exposure and a 2.11 log reduction after 60 min exposure (Table 1). Furthermore, a D-value was calculated using the reciprocal of the slopes in Figure 1 and a linear regression was computed from log D-value versus time giving us a D-value of 22.72 min. In laymen terms with the use of the bipolar ionization device an expected 90% reduction (1 log) of *E. coli* will occur every 24 min, until a maximum reduction is achieved.

In conclusion, the GPS-IBAR-36 demonstrated the ability to disinfect *E. coli* from the air with a 99.54% reduction after 30 min exposure and a 99.23% reduction after 60 min exposure. Furthermore, these results demonstrate that the bipolar ionization system tested does not require direct line of sight to produce kill rates like ultraviolet light. The bipolar ionization system's kill rates are indicative of those in the entire space.

Farbod Nekouei, M.S., Laboratory Manager
or Other Approved Signatory