



Genesis Air Purification Technology is Effective at Inactivating SARS-CoV-2

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In response to the COVID -19 pandemic, Genesis Air subjected their patented air purification technology to challenge testing with the SARS-CoV-2 active virus in the BSL-4 national laboratory of the University of Texas Medical Branch (UTMB) in Galveston, TX in June 2021. SARS-COV-2, an enveloped RNA virus, has the potential to exist in both droplet and aerosol forms. It has also been studied and confirmed to be infective six to seven feet from the source (1-7). Therefore, technologies that are capable of inactivating the virus in spaces where individuals are within close proximity is essential to creating safer environments. Most transmission of the SARS virus occurs indoors and between people in close proximity to each other (8). Technologies that either clean the air and surfaces (ie disinfectants) and/or cannot be used when people are present (ie ultraviolet radiation) have limited application and cannot treat the occupied environment when it is most critical. Genesis Air purification technology is safe for occupied spaces and is currently in use in office buildings, commercial spaces, care homes, hospitals, schools, and residences to name a few. Historically, Genesis Air has been shown to eliminate odors and is effective at eliminating MS2 bacteriophage (a viral surrogate), *Aspergillus niger* (fungal spores) and multi-drug resistant organisms such as MRSA from the environment (9, 10, 11).

The SARS-CoV-2 challenge testing experimental design included culture of virus, aerosolization of virus using a nebulizer, and detection of viable virus before and after single pass through the Genesis unit. The Genesis Air unit consists of the photocatalytic oxidation (PCO) panel, a Minimum Efficiency Reporting Value (MERV) 13 pre-filter and an energy source. Viable virus was collected using a Biosampler and viability was quantified with plaque assays. Three experimental configurations were tested:

- 1) Genesis Air unit present but turned off, with no pre-filter – no intervention control (test runs 1-3).
- 2) Genesis Air unit present and turned on, with no pre-filter – panel alone intervention (test runs 4-6).
- 3) Genesis Air unit present and turned on, with MERV 13 pre-filter present – panel plus filter intervention (test runs 7-9).

Each experimental configuration was tested in triplicate. Aerosolized concentrations ranged from 3×10^6 to 2×10^7 viral particles per milliliter (ml) equaling to TCID₅₀* per milliliter of 4.65 to 5.37 pre-unit and 280 liters of air passed through at 125 feet per minute**. Biosampler 1 was placed upstream of the unit to collect aerosols as they traveled from the nebulizer to the unit. Biosampler 2 was placed downstream of the unit to collect aerosols after they passed through the unit. Ambient reduction in viable virus from the nebulizer to Biosampler 1 resulted in 4×10^4 to 2×10^5 viral particles/ml which equates to TCID₅₀/ml of 4.65 to 5.37, with no statistical significance for all nine nebulizer sprays. For sprays 1-3 (control) there was also no statistically significant reduction in viral activity between Biosampler 1 and 2, and the average net reduction was 0.31 log TCID₅₀/ml (less than half of one log reduction). For sprays 4-6 (Genesis Air panel on/ no filter), there was a significant reduction in active virus between Biosampler 1 and 2, with significantly less viable virus detected after the aerosol passed through the Genesis Air panel, $p=.0453$, and a 1.55 log TCID₅₀/ml reduction. For sprays 7-9 (Genesis Air on with MERV 13 filter) there was also a statistically significant reduction in viable virus from Biosampler 1 to 2, $p=.0195$, bringing the viable virus detection below the lower limit of detection (LLOD) with an average log reduction TCID₅₀/ml greater than or equal to 3.37.



Figure 1. Laboratory hood set up with aerosolization and detection equipment and the Genesis Air technology. From right to left: nebulizer, Biosampler 1 (upstream), MERV filter, Genesis PCO panel, and Biosampler 2 (downstream).



Figure 2. Nebulizer sprays 1-9 with viral concentration per milliliter at the source nebulizer and at both the upstream Biosampler 1 and 2. LLOD – Lower Limit of Detection

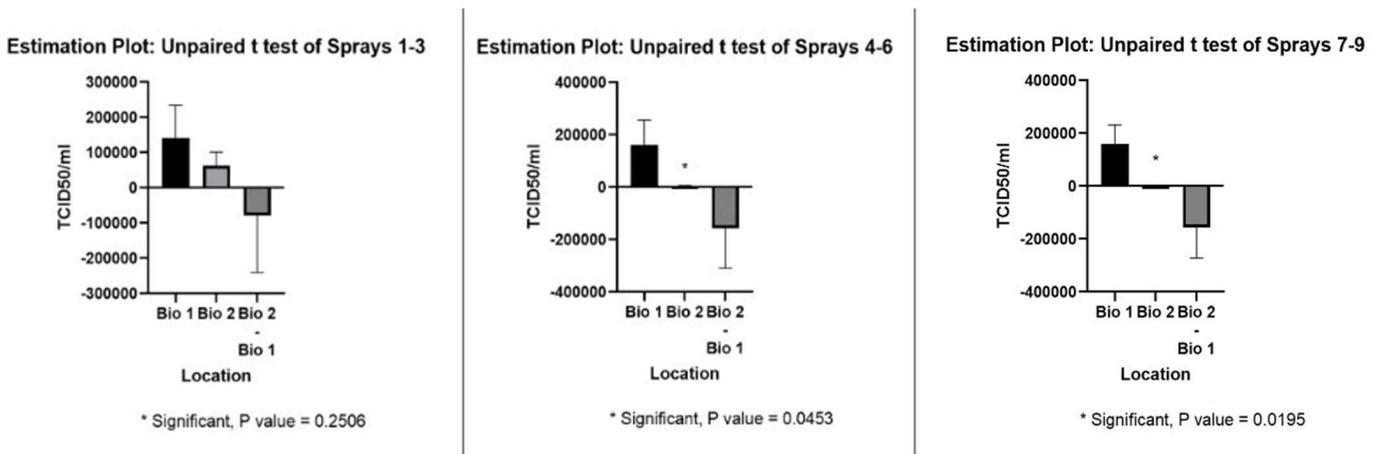
	Dose applied through nebulizer	Biosampler 1 (Upstream)	Biosampler 2 (Downstream)	Average % Reduction
Spray 1	3,290,000	232,000	107,000	63
Spray 2	14,000,000	45,100	45,100	
Spray 3	8,920,000	147,000	36,900	
Spray 4	6,810,000	55,100	6,520	95
Spray 5	14,700,000	237,000	2,320	
Spray 6	23,700,000	192,000	3,690	
Spray 7	4,990,000	94,000	<60 (LLOD)	>99.99
Spray 8	6,810,000	23,700	<60 (LLOD)	
Spray 9	14,700,000	14,700	<60 (LLOD)	



Figure 3. Aerosol SARS-CoV-2 Challenge Testing Log Reduction Data

Aerosol run	Test parameter	Pre-unit viral concentration (log TCID ₅₀ /ml)	Post-unit viral concentration (log TCID ₅₀ /ml)	Net viral reduction (log TCID ₅₀ /ml)	Average net viral reduction (log TCID ₅₀ /ml)
1	Unit OFF; panel present; no filter	5.37	5.03	0.34	0.31
2		4.65	4.65	0.00	
3		5.17	4.57	0.60	
4	Unit ON; panel present; no filter	4.74	3.81	0.93	1.55
5		5.37	3.37	2.01	
6		5.28	3.57	1.72	
7	Unit ON; panel present; filter present	4.98	≤1.80	≥3.17	≥3.37
8		5.37	≤1.80	≥3.57	
9		5.17	≤1.80	≥3.37	

Figure 4. Statistical analysis of viable virus detection. Detection of viable virus was significantly reduced when the air stream passed through the device with the panel on and no pre-filter (p=.0453), sprays 4-6, and through both the device with the panel on and the pre-filter (p=.0195), sprays 7-9. Viable virus detection was not significantly reduced when the air stream passed through the device with the panel off and no pre-filter (p=.2506).



In summary, the Genesis Airs air purification technology is effective at inactivating 95% of SARS-CoV-2 when using only the activated PCO panel without a pre-filter and is effective at inactivating greater than 99.9% of viable virus when used in combination with a MERV 13 pre-filter.



*TCID50/ml of Tissue Culture Infectious Dose per milliliter is the viral titer that kills 50% of the tissue culture. It is estimated that infected patients expel viable SARS-CoV-2 in concentrations ranging from 6000 to 74,000 TCID50/ml (14).

**Due to biohazardous nature of the experiments, the airflow and amount of air that passed through the device were limited by the laboratory set up and capability.

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Acknowledgement

We would like to thank Dr. William S. Lawrence, PhD, assistant professor of Microbiology and Immunology and manager of Aerobiology Service Center and his staff, from the University of Texas Medical Branch, for conducting the nebulization and detection of viable SARS-CoV-2 virus.