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Assessment of the antiviral activity of the Inspired TEC STAT Unit

Test Organism

Human coronavirus 229E
(ATCC VR-740)

Study Personnel

Andrew Rabe, BS
Priscilla Valenzuela, MS
Stephanie Boone, PhD
Luisa Ikner, PhD
Charles Gerba, PhD

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Purpose:

To determine the ability of the Inspired TEC STAT unit, an air ionization device, to inactivate infectious human coronavirus 229E (HCoV-229E) on a hard, nonporous surface. HCoV-229E causes common cold symptoms and has been used as a surrogate for the inactivation of SARS-CoV-2 virus.

Methods:

The STAT unit is an ion generator that produces positively and negatively charged cluster ions. The unit was assessed within a 16 X 12 X 10 ft environmental test chamber with shelves positioned at 3 feet relative to the floor. The unit was installed onto a wall in the test chamber per the manufacturer's instructions (vent towards the floor). It was powered on and allowed to operate within the test chamber for at least three hours before the assessment was started. The room temperature range was 23°C to 24°C, with humidity varying from 57-60% during the test period.

HCoV-229E (ATCC VR-740) was propagated and assayed using the human fetal fibroblast, MRC-5 cell line (ATCC CCL-171). To obtain virus, infected MRC-5 cells were frozen and thawed three times at -20°C. Cell debris were removed by centrifugation at 1000 g for 20 minutes. Supernatant was resuspended in 9-12% polyethylene glycol (MW 8000) and 0.5 M sodium chloride, then stirred overnight at 4°C. The virus suspension was centrifuged again at 10,000 g for 60 minutes then the pellet was resuspended in 0.01 M phosphate buffer solution (PBS) to 5% of the original volume.

Cleaned and autoclaved glass slides (1"x 3") were used as the carriers in the assay. The human coronavirus 229E stock thawed from -80°C on the day of the study, and amended to obtain a 5% organic soil load using fetal bovine serum (FBS). Aliquots of 0.1 mL were spread onto glass slide carriers using the tip of a sterile pipette. Inoculated slides were dried within sterile Petri dishes (lids slightly ajar) for at least 30 minutes (23 °C; 57-60% RH). Two glass slides were collected and harvested upon drying to determine the levels of infectious viruses present on inoculated carriers at the start of the STAT test exposure.

The STAT unit was powered on and allowed to operate within the environmental chamber (door closed) for at least three hours prior to testing. The dried slides were placed onto the shelves. The door to the chamber was closed, and the carriers were exposed for 30 minutes to the STAT device. Carrier sets were harvested in replicates of two. All slides were incubated uncovered during the STAT ion exposure test. Control slides were placed into an adjacent room with no STAT unit, and were harvested concurrently in duplicate upon each exposure time.

After the designated exposures, the glass slides were placed into 50 ml tubes and rinsed with 1 ml of minimal essential media (MEM) 2-3 times. The carriers were then scraped using a sterile cell scraper to further detach viruses. The resulting virus suspension was enumerated using the tissue culture infectious dose technique ($TCID_{50}$) (Payment and Trudel 1993). This technique determines the dilution at which 50% of the cells show cytopathic effect (CPE). Virus suspensions were serially diluted in 0% FBS MEM, and then assayed using 96-well trays containing the MRC-5 cell line. Six replicate wells were plated for each dilution. The cell culture trays were incubated for 30 minutes at 35°C , and then each well received additional media containing 2% FBS (Corning, Woodland, CA). Assay trays were incubated for seven days. Sample and control plate wells that indicated CPE or other cellular changes were recorded.

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Table 1. Antiviral efficacy of the Inspired TEC STAT device against Human Coronavirus 229E[a,b,c,d]

Sample Type	Exposure Time	Carrier Height Position	Virus Recovery (Log_{10} per Carrier)	Mean Virus Recovery (Log_{10})	Log_{10} Reduction	Percent Reduction (%)
Control (non-exposed)	0 mins	N.A.	6.33	6.33	N.A.	N.A.
			6.33			
Control (non-exposed)	30 mins	N.A.	5.83	5.67	0.67	76.8%
			5.50			
Test (STAT-exposed)		3 ft	3.00	3.08	2.58	99.8%
			3.17			

[a] N.A.: Not applicable; N.D.: Not determined; UNR: Unreadable.

[b] Carrier height placement measured relative to the environmental chamber floor.

[c] Log_{10} and percent reductions for timed control carriers calculated relative to Time Zero (0 min) Control mean.

[d] Log_{10} and percent reductions for test carriers calculated relative to respective timed control mean.

Results: log reduction as compared with controls

The STAT device demonstrated impressive reductions of infectious human coronavirus 229E following exposure period of 30-minutes relative to the unexposed controls.

References

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