PuriFi Labs™

PuriFi AMP technology tested by the EPA's Homeland Security Research Division under highly rigorous HVAC mechanical conditions.

EPA Test Report Summary

Without a filter. Without chemicals.

The air handler unit equipped with PuriFi, operating at 350 CFM, and no air filter, achieved 99% total neutralization within 60 minutes.*

(Total neutralization includes effects from PuriFi, air flow, and natural decay)

Air handler unit equipped with PuriFi also achieved an 86% greater reduction within 60 minutes than air handler control test using only air flow and natural decay.*

*As shown in Figure 3 (A) and (B) of the EPA Web Update, total neutralization represents the average total log reduction from five viral aerosol tests. Environmental Test Conditions: 3000 cu. ft. biosafety room, 70° -73° F, 30%-35°/o RH, 350 CFM, and 7 ACH. To view the full report visit: Purifilabs.com/test-reports.

PuriFi AMP technology tested by the EPA's Homeland Security Research Division under highly rigorous HVAC mechanical conditions.

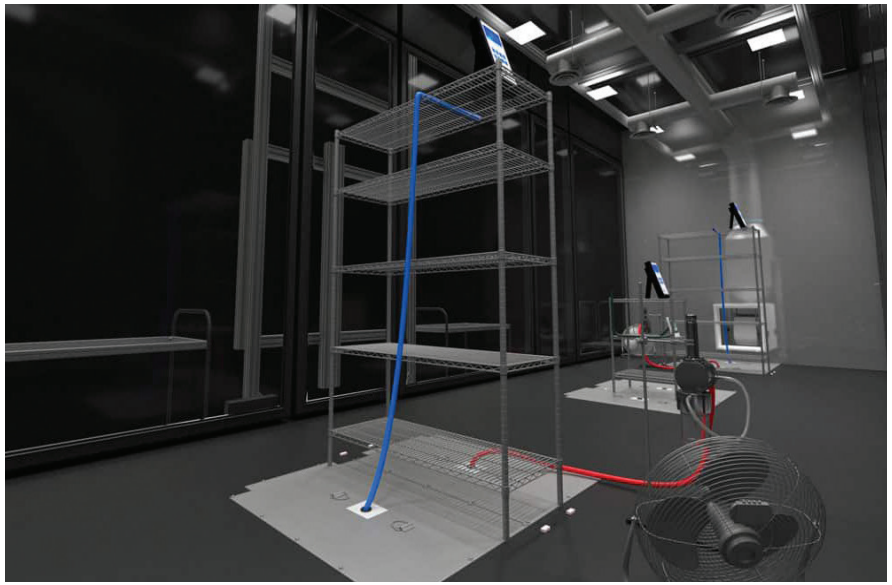
The testing conducted will assist the EPA in researching standardized test processes and to better assess the efficacy of aerosol treatment technologies in reducing the transmission of airborne viruses and other diseases in enclosed spaces.

Purpose

Develop and research potential methods for standardizing airborne pathogen efficacy testing for duct-mounted and in-room air purification devices. Create a rigorous test environment to evaluate air purification devices and their respective in-room efficacy against airborne pathogens. Results of the study intended to evidence the potential added benefit that aerosol treatment technologies may have in reducing airborne disease transmissions and inform the development of standardized methods for testing.

Method

The EPA utilized one of the largest available test chambers, a specially designed 3000 cu. ft. biosafety room, to simulate a high turbulence indoor environment with a highly concentrated viral load. PuriFi's technology was duct-mounted to a real-world HVAC fan system operating at only 350 cubic feet per minute (CFM), which is significantly less than the typical 1500-2000 CFM that a single device would normally see in real-world applications, but the 350 CFM provided a real-world air change rate for the size of this specific biosafety room (7 ACH).

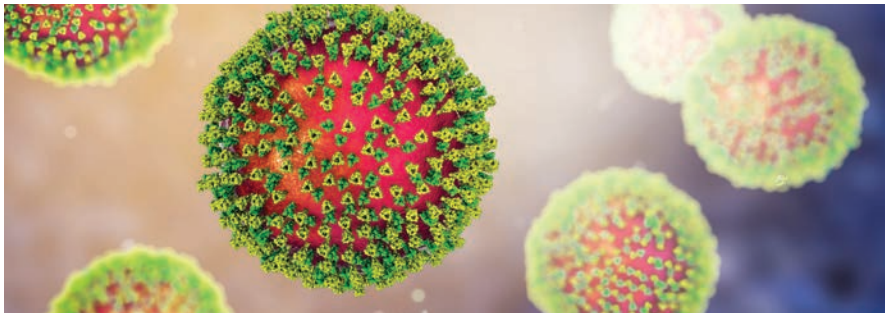


- **Room Size:** 3,000 cubic feet
- **Temperature:** 70°-73° F
- **Relative Humidity:** 30%-35%
- **HVAC System Airflow:** 350 CFM
- **Air Changes Per Hour:** 7 ACH
- **Total Duct Travel Distance:** 50 Feet

The EPA used a non-enveloped viral surrogate, MS2, which is 4x-7x smaller than SARS-CoV-2[1,2] and 7x-10x more resistant than coronaviruses[3].

Billions of nano-sized viral aerosols were nebulized in sterilized deionized water directly downstream of two floor-mounted mixing fans operating at 1443 feet per minute (FPM). The count median diameter of the aerosolized particles was 46 nm (0.046 µm) at the beginning of each test (time = 0 minutes) and increased over the duration of the test to 100 nm (0.1 µm) at the end of 120 minutes.

Aerosol samples were collected at 5 ft. high from each end of the room while operating at a humidity level of approximately 30% RH, the most challenging humidity condition for neutralizing MS2[4].



Virus Composition and Particle Size:

- **Virus Type:** MS2, Non-enveloped RNA Virus
- **Viral Strength:** Highly resistant, 7x-10x more resistant to neutralization than coronaviruses[3]
- **Virus Diameter:** 23 nm to 28 nm, 4x-7x smaller than SARS-CoV-2[1,2]
- **Aerosol Medium:** Sterilized Deionized Water
- **Aerosol Particle Size:** ~46 nm to ~100 nm, 5x-65x smaller than most human-emitted aerosols[1], 3x-15x smaller than particle size used in HEPA filter testing[5]

Results

Airborne viral sampling sites located in the breathing zone at 5 ft. high, at each end of the 3,000 cubic foot chamber, collected at least four time-point samples per location during an average test period of 90-120 minutes. The test process was repeated five times, each on different days, over a three-week period.

Interim Web Summary Highlights:

- Air handler unit equipped with PuriFi, operating at 350 CFM, and no air filter, achieved 99% total neutralization within 60 minutes*

  (Total neutralization includes effects from PuriFi, air flow, and natural decay)

- Air handler unit equipped with PuriFi Airborne Molecular Purification (AMP) technology achieved an 86% greater reduction within 60 minutes than air handler control test using only air flow and natural decay*

Testing Requirements

For the comparative control tests, the EPA did not test against natural viral decay or adjust the speed of the mixing fans. Instead, the central HVAC fan system and the two high-speed mixing fans, simulated a high turbulence indoor environment across four discrete control tests conducted while fully operating the HVAC fan system, without PuriFi's AMP technology activated. For reporting purposes, all tests are accounted for under this method, regardless of any potential anomalies or outliers in the results. AMP technology by PuriFi is the first technology tested as part of this test method development research.

[1] Modality of human expired aerosol size distributions, G.R.Johnson, L.Morawska, Z.D.Ristovski, M.Hargreaves, K.Mengersen, C.Y.H.Chao, M.P.Wan, Y.Li, X.Xie, D.Katoshevski, S.Corbett, et al. Journal of Aerosol Science, Volume 42, Issue 12, 2011, Pages 839-851, ISSN 0021-8502, https://doi.org/10.1016/j.jaerosci.2011.07.009. https://www.sciencedirect.com/science/article/pii/S0969212603002223

[2] Inhaled aerosols: Their role in COVID-19 transmission, including biophysical interactions in the lungs, T. R. Sosnowski, et al. Current Opinion in Colloid & Interface Science, Volume 54, 2021, 101451, ISSN 1359-0294, https://doi.org/10.1016/j.cocis.2021.101451.https://www.sciencedirect.com/science/article/pii/S1359029421000352

[3] Comparison of Five Bacteriophages as Models for Viral Aerosol Studies, N. Turgeon, M. Toulouse, B. Martel, S. Moineau, C. Duchaine, et al. Appl Environ Microbiol. 2014 Jul; 80(14): 4242-4250. doi: 10.1128/AEM.00767-14 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4068686/

[4] Survival of Airborne MS2 Bacteriophage Generated from Human Saliva, Artificial Saliva, and Cell Culture Medium, Z. Zuo, et al. Appl Environ Microbiol. 2014 May; 80(9): 2796-2803. doi: 10.1128/AEM.00056-14 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3993287/pdf/zam2796.pdf

[5] https://www.epa.gov/indoor-air-quality-iaq/what-hepa-filter-1

**As shown in Figure 3 (A) and (B) of the EPA Web Update, total neutralization represents the average total log reduction from five viral aerosol tests. Environmental Test Conditions: 3000 cu. ft. biosafety room, 70° -73° F, 30%-35°/o RH, 350 CFM, and 7 ACH. To view the full report visit: Purifilabs.com/test-reports.*

While PuriFi significantly reduced MS2 in airborne testing, there is currently no universal solution for preventing coronavirus infections. PuriFi Labs encourages following hygiene guidelines in the manner suggested by government authorities.