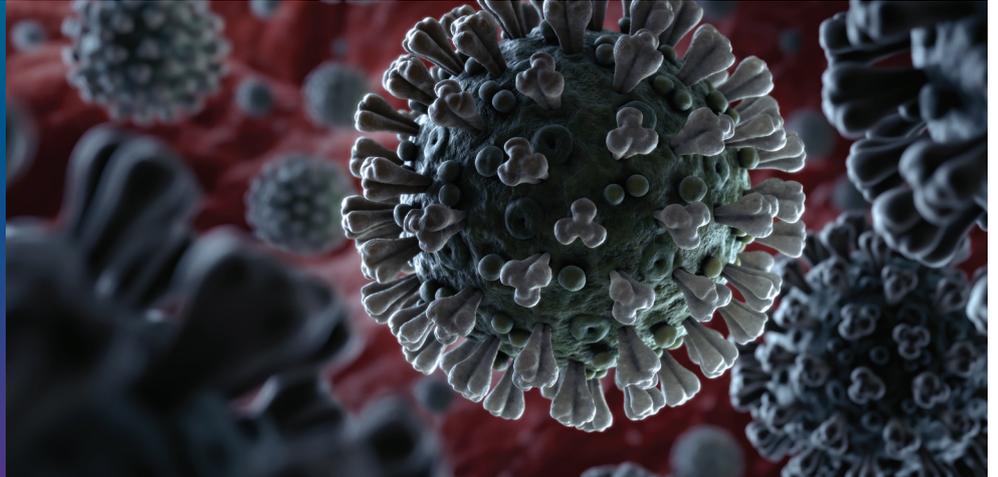


TOXI-GUARD® Protection Against Virus Penetration into Drug Vials



Transmission of Viruses

Transmission of influenza and other viruses between humans may occur by three routes:

1. Direct or indirect contact between an infected and a susceptible person, usually resulting in contamination of a susceptible person's hands followed by hand to respiratory mucosa contact
2. Large droplet spray of respiratory fluid
3. Aerosols generated by release of smaller, virus containing droplets, as may occur during breathing and coughing ¹

Thus, viruses are carried in the air on the aerosol droplets, or other particles.

Standard tests were developed to evaluate the ability of the charcoal filter or membrane to filter or capture viruses aerosolized in an air stream.

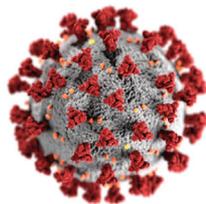
Applicable Standards

ASTM F2100
EN 14683
ASTM F2101

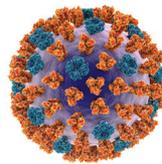
Virus Sizes

Viruses are much smaller compared to bacteria. Therefore, there is a risk of their escape through filters that are designed for bacterial protection. Example of virus sizes:

Coronaviruses - 125 nm ²
Influenza virus - 80-120 nm ³
Adenovirus - 70-100 nm ⁴
Polio virus - 30 nm ⁵
Bacteriophage Phi X174 - 31 nm ⁶
MS-2 coliphage - 27 nm ⁷



Coronaviruses
125 nm



Influenza virus
80-120 nm



Adenovirus
70-100 nm



Bacteriophage Phi X174
31 nm

TOXI-GUARD® air cleaning technology is composed of a hydrophobic filtration membrane (Versapor®) having pores of 0.2 µm, and an activated carbon filter (Flexzorb™)

Protective Effect of the Membrane ⁸

The Viral Filtration Efficiency (VFE) of the Versapor® membrane family was tested by Nelson Labs US. An aerosol of a challenge virus, bacteriophage phi 164, was used. The droplet size of the aerosol was strictly controlled and had a mean particle size of 2.9 µm. The flow rate of the aerosol through the membrane test sample was 28.3 Liter per minute.

It was found that the membrane prevents viruses from passing through at an efficiency greater than 99.9%. Practically, no virus passed the membrane in this study.

Protective Effect of the Activated Carbon Cloth ⁹

The viral capture efficiency of the Flexzorb™ active carbon filter present in the TOXI-GUARD® was tested by the Health Protection Agency (HPA), UK, using a different virus model - MS-2 coliphage. The test revealed moderate capture level (~10%) of the virus. The carbon layer was also shown to have a unique ability

to deactivate a virus without chemical intervention. A deactivation rate of up to 93% was achieved by Flexzorb™. These protective effects of the activated carbon layer are added to the efficient viral filtration ability of the 0.2µm membrane.

Conclusion

Both protective layers of the TOXI-GUARD® are active against airborne viruses, and prevent the risk of virus penetration into the vial.



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Coronavirus photo by CDC on Unsplash