

Antiviral Effects of Silver

Applied Silver's SilvaClean® infection control technology is based on the powerful broad-based antimicrobial capabilities of silver ions. Silver exhibits killing properties against bacteria, mold, mildew and viruses that is well-documented in literature.

It has been understood for centuries that silver is an effective antimicrobial. In recent years, scientists and clinicians have specifically studied the impact of silver on viruses. Following are key peer-reviewed studies that support why silver is also effective as an antiviral.

1) Silver nanoparticles prevent coronaviruses from infecting mammalian cells in vitro.

Key scientific finding: Silver nanoparticles inhibit viral entry into hosts cells, therefore preventing virus-mediated infection.

Reference: Inhibitory effect of silver nanomaterials on transmissible virus-induced host cell infections. *Biomaterials (2014): 35; 4195-4203*

2) Silver is effective against enveloped and non-enveloped viruses.

Key scientific finding: Silver inactivates enveloped viruses (e.g. coronaviruses) through a charge-based interaction with their outer lipid envelope layer. Silver inactivates non-enveloped viruses through formation of bonds with sulfur groups on key proteins.

Reference: Antiviral Activity of Graphene–Silver Nanocomposites against Non-Enveloped and Enveloped Viruses. *Int. J. Environ. Res. Public Health*2016,13, 430

3) Disinfectants containing silver inactivate the hard-to-kill norovirus within 30 mins.

Key scientific finding: Exposure of norovirus to silver citrate results in physical (morphological) changes in norovirus within 30 mins, similar to observations with heat, high pressure and copper.

Reference: Efficacy of a disinfectant containing silver dihydrogen citrate against GI.6 and GII.4 human norovirus. *Journal of Applied Microbiology*, 2016, 122, 78–86.

4) Silver ion containing powders kills human and cat coronaviruses.

Key scientific finding: Zeolites containing silver and silver/copper caused significant reductions of coronavirus 229E after 1 h in suspension.

Reference: Assessment of the Antiviral Properties of Zeolites Containing Metal Ions. *Food Environ Virol (2009) 1:37–41*

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5) Silver ions inactivate the flu virus.

Key scientific findings: Silver selectively inactivates key enzyme neuraminidase through formation of a disulfide bond, impairing the ability of the flu virus to cause an infection.

Reference: Comparison of the Antiviral Effect of Solid-State Copper and Silver Compounds. J Hazard Mater. 2016 Jul 15; 312:1-7.

6) Silver ions used to contain viral infections in honeybee populations.

Key scientific finding: Silver based treatment doubles the survival rates of honeybees infected with Sacbrood virus.

Reference: Efficacy of silver ions against Sacbrood virus infection in the Eastern honeybee *Apis cerana*. J Vet Sci 2015, 16(3), 289-295

7) Silver is a gentle and powerful broad-spectrum antimicrobial.

Key scientific findings: Review article describing silver antimicrobial and antiviral activities against a variety of pathogens.

Reference: Inhibitory Antimicrobial silver: an unprecedented anionic effect. Sci Rep. 2014 Nov 24;4:7161.

8) Silver coating is used to kill HIV and many other viruses.

Key scientific findings: Over 90% reduction in viral titers were observed within 4 hours of exposure to silver for HIV, influenza, herpes simplex and dengue viruses.

Reference: Protective Hybrid Coating Containing Silver, Copper and Zinc Cations Effective Against Human Immunodeficiency Virus and Other Enveloped Viruses. BMC Microbiol. 2016 Apr 1;16

In addition, Applied Silver has initiated testing to further understand specific kill times of silver ions as delivered through SilvaClean, on coronaviruses. The Applied Silver team is planning to publish their findings in the future and will continue to provide data as it becomes available. The company also plans to incorporate new data findings into future EPA registrations.

The combination of silver's ability to effectively combat viruses and antibiotic-resistant pathogens makes it a highly effective infection control technology to help address response to public health situations and associated concerns around secondary infections by antibiotic-resistant pathogens.

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