White Paper (long version)

Ozone: Safety and Antimicrobial Efficacy Overview

by Dr. Ian Van Trump

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Ozone: Safety and Antimicrobial Efficacy Overview

1. Introduction

Ozone (O_3) is a naturally occurring, highly reactive molecule. Historically, ozone has been used as an antimicrobial agent in a wide variety of use patterns, including the treatment of both drinking and municipal wastewater.[1-2] This capability is due to ozone's ability to oxidize organic molecules, including biomolecules present in and on microorganisms such as bacteria and viruses.[3]

Ozone can be formed through various mechanisms, including natural ultraviolet (UV) irradiation of oxygen molecules in the earth's stratosphere.[3,4] For commercial and industrial applications, ozone can also be intentionally generated via a variety of mechanisms including corona discharge and UV irradiation of atmospheric oxygen. Regardless of how it is generated, gaseous ozone decomposes into molecular oxygen (O_2) in the ambient environment and has a half-life that can range from shorter than one hour to longer than one day at room temperature depending on humidity, air movement, and various other environmental factors.[1,5]

Ozone was first used in water treatment in 1893, and since this time it has been used to reduce odors, promote the oxidative degradation of chemical pollutants, and to kill microorganisms.[3,6,7] Given its widespread use, ozone has been well-studied with respect to its characteristics and its ability to kill undesirable microorganisms such as potentially pathogenic bacteria and viruses. The purpose of this whitepaper is to provide a brief summary of both the toxicological and efficacy characteristics of ozone when used for these purposes.

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[1] Dev Kumar, G., Mishra, A., Dunn, L., Townsend, A., Oguadinma, I. C., Bright, K. R., & Gerba, C. P. (2020). Biocides and Novel Antimicrobial Agents for the Mitigation of Coronaviruses. Frontiers in microbiology, 11, 1351. https://doi.org/10.3389/fmicb.2020.01351

[2] Foarde, K. K., D. W. VanOsdell, & Steiber. R. S. (1997). Investigation of Gas-Phase Ozone as a Potential Biocide. Applied Occupational and Environmental Hygiene, 12(8):535-542.

[3] United States Environmental Protection Agency. (1986). Air Quality Criteria for Ozone and Other Photochemical Oxidants, Volume 1.

[4] Ross J. Salawitch (Lead Author), David W. Fahey, Michaela I. Hegglin, Laura A. McBride, Walter R. Tribett, Sarah J. Doherty, Twenty Questions and Answers About the Ozone Layer: 2018 Update, Scientific Assessment of Ozone Depletion: 2018, 84 pp., World Meteorological Organization, Geneva, Switzerland, 2019.

[5] McClurkin, J. D., Maier, D. E. (2010). Half-Life Time of Ozone as a Function of Air Conditions and Movement. Proceedings of the 10th International Working Conference on Stored Product Protection. No. 425. https://doi.org/10.5073/jka.2010.425.167.326

[6] Dyas, A., Boughton, B. J., Das, B. C. (1983). Ozone Killing Action Against Bacterial and Fungal Species; Microbiological Testing of a Domestic Ozone Generator. J Clin Pathol. 36(10):1102-4. doi: 10.1136/jcp.36.10.1102.

[7] United States Environmental Protection Agency. (2018). Residential Air Cleaners: A Technical Summary.

2. Toxicological Characteristics

Ozone is a broadly reactive chemical and has been extensively studied with respect to its toxicological characteristics. The information below summarizes selected results from evaluations of the toxicological characteristics of ozone. As with many chemicals, ozone can exhibit toxicity against various organisms, including human beings and other mammals, at sufficiently high exposure levels. As such, regulatory and other authorities in the United States (U.S.) have implemented guidelines for allowable ozone concentrations and time periods to help ensure that ozone exposures in various use environments are sufficiently protective of human health. Additional discussion on these regulatory constraints for allowable ozone concentrations and exposures is provided in Section 3 below.

In as early as 1874, Dewar and McKendrick reported their series of experimental observations on various small animals and on themselves to determine what action ozone exerts on the body.[8] Among other conclusions, they reported that at sufficiently high concentrations ozone exercised a destructive action on living animal tissue and acts as an irritant to mucous membranes. In more recent years, the United States Environmental Protection Agency (EPA) has summarized overarching observations from a number of short-term or acute studies of the toxicological impacts of ozone. These observations included reversible and transient decrements in pulmonary function in otherwise healthy human adults exposed to ≥0.08 parts per million (ppm) ozone. It has also been observed that acute ozone exposure causes an inflammatory response lasting for at least 18 hours, although repeated exposure over several days leads to some attenuation of the effects of ozone exposure.[9,10] Ultman *et al*. studied the short-term effect of ozone on lung function, showing a decrease in forced expiratory volume in 1 second (FEV_1) and cross-sectional area of the peripheral lung (A_P) of (-14±13)% and (-8±9)%, respectively, after 1 hour exposure to 0.25 ppm ozone.[11] Similarly, Foster *et al.* observed that, after an acute ozone exposure of 0.35 ppm for 2.2 hours, subjects experienced an average 24% decrease in the washout rate (a measure of how quickly nitrogen gas is washed out of a subjects lungs when breathing in 100% oxygen); while at 24 hours post-exposure, half of the subjects had decreased

[8] Dewar, J., KcKendrick, J. G. (1874). On the Physiological Action of Ozone. Royal Society of Edinburgh, Neill and Company.

[9] United States Environmental Protection Agency. (2006). Air Quality Criteria for Ozone and Related Photochemical Oxidants, Volume 1.

[10] United States Environmental Protection Agency. (2020). Integrated Science Assessment for Ozone and Related Oxidants.

[11] Ultman JS, Ben-Jebria A, Arnold SF. Uptake distribution of ozone in human lungs: intersubject variability in physiologic response. Res Rep Health Eff Inst. 2004 Nov;(125):1-23; discussion 25-30. PMID: 15675715.

washout rate.[12] Even at lower concentrations, FEV_1 and forced vital capacity (FVC, the total amount of air exhaled during the FEV_1 test) show reductions after 6.6 hours of exposure during quasi continuous exercise (Table 1).

Table 1: FEV_1 and FVC values after 6.6 hours of quasi continuous moderate exercise at ventilation rates of 35 L/min.

Source	Ozone Concentration	FEV_1	FVC
Adams 2002[13]	0.12 ppm	-13.25±11.19 -13.02±9.21	-10.74±8.24 -10.95±7.88
Adams 2003[14]	0.08 ppm	-3.51±7.43 -3.64±7.80 -3.12±6.08 -2.95±5.58	-3.67±6.64 -4.07±6.61 -3.91±5.72 -3.10±3.95
Horstman[15]	0.08 ppm 0.10 ppm 0.12 ppm	-7.0 -7.0 -12.3	-4.9 -5.4 -9.4
Folinsbee[16]	0.12 ppm	-13.0±15.4	-8.3±6.2

In addition to these quantifiable responses to ozone inhalation, short-term ozone exposure during physical activity is consistently reported to have subjective respiratory tract symptoms including airway irritation, cough, and pain on deep inspiration.[16] Animal and human studies also indicate that, while inflammation is lessened after repeated exposures, repeated

[12] W. M. Foster, G. G. Weinmann, E. Menkes, K. Macri, Acute Exposure of Humans to Ozone Impairs Small Airway Function, The Annals of Occupational Hygiene, Volume 41, Issue inhaled_particles_VIII, January 1997, Pages 659–666, doi:10.1093/annhyg/41.inhaled_particles_VIII.659

[13] Adams WC. Comparison of chamber and face-mask 6.6-hour exposures to ozone on pulmonary function and symptoms responses. Inhal Toxicol. 2002 Jul;14(7):745-64. doi: 10.1080/08958370290084610. PMID: 12122573.

[14] Adams WC. Comparison of chamber and face mask 6.6-hour exposure to 0.08 ppm ozone via square-wave and triangular profiles on pulmonary responses. Inhal Toxicol. 2003 Mar;15(3):265-81. doi: 10.1080/08958370304505. PMID: 12579457.

[15] Horstman DH, Folinsbee LJ, Ives PJ, Abdul-Salaam S, McDonnell WF. Ozone concentration and pulmonary response relationships for 6.6-hour exposures with five hours of moderate exercise to 0.08, 0.10, and 0.12 ppm. Am Rev Respir Dis. 1990 Nov;142(5):1158-63. doi: 10.1164/ajrccm/142.5.1158. PMID: 2240838.

[16] Folinsbee LJ, McDonnell WF, Horstman DH. Pulmonary function and symptom responses after 6.6-hour exposure to 0.12 ppm ozone with moderate exercise. JAPCA. 1988 Jan;38(1):28-35. doi: 10.1080/08940630.1988.10466349. PMID: 3356996.

ozone exposures at concentrations between 0.2 ppm and 0.5 ppm results in continued cellular damage.[17-18]

3. Regulatory Context for Ozone Safety

As mentioned above, regulatory authorities in the U.S. have developed guidelines and recommendations for ozone exposures in light of the available toxicological information for this chemical. The limits placed on ozone exposures by these entities are intended to help ensure that unacceptable levels of exposure will not occur due to the natural presence of this chemical in the environment, its unintended production from various anthropogenic sources, or intentional use of ozone for myriad residential, commercial, industrial, and medical uses.

Ozone concentration standards were initially introduced in 1971, when the U.S. "National Primary and Secondary Ambient Air Quality Standards" ruled that the maximum 1-hour average concentration of total photochemical oxidants (which includes ozone) in ambient air was 0.08 ppm.[19] The U.S. Environmental Protection Agency (EPA) later released a report in 1978 with details on the air quality criteria for ozone, which described impairment to lung function with short-term exposures of ozone concentrations as low as 0.3 ppm.[20] Air quality requirements for photochemical oxidants were subsequently made more specific to ozone in 1979 and the air quality standard for ozone was raised to a maximum 1-hour average ozone concentration of 0.12 ppm.[21]

Presently, a number of U.S. agencies give requirements and recommendations for acceptable gaseous ozone concentration limits. The latest and current EPA report regarding outdoor air quality standards for ozone lists an ozone limit of 0.07 ppm.[22] The U.S. Occupational Safety and Health Administration (OSHA) lists employee exposure limit to 0.1 ppm, measured as the maximum 8-hour time weighted average ozone concentration,[23] while the National

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[17] Tepper JS, Costa DL, Lehmann JR, Weber MF, Hatch GE. Unattenuated structural and biochemical alterations in the rat lung during functional adaptation to ozone. Am Rev Respir Dis. 1989 Aug;140(2):493-501. doi: 10.1164/ajrccm/140.2.493. PMID: 2527482.

[18] Devlin, R.B. & Folinsbee, L.J. & Biscardi, F. & Hatch, Gary & Becker, S. & Madden, M.C. & Robbins, M. & Koren, H.S.. (1997). Inflammation and cell damage induced by repeated exposure of humans to ozone. Inhalation Toxicology. 9. 211-235.

[19] United States Federal Register. (1971). Federal Register, Volume 36, Number 84, National Primary and Secondary Ambient Air Quality Standards.

[20] United States Environmental Protection Agency. (1978). Air Quality Criteria for Ozone and Other Photochemical Oxidants, Volume 1.

[21] United States Federal Register. (1979). Federal Register, Volume 44, Number 28, National Primary and Secondary Air Quality Standards for Photochemical Oxidants.

[22] United States Federal Register. (2015). Federal Register, Volume 80, Number 206, National Ambient Air Quality Standards for Ozone.

[23] 21 C.F.R. § 1910.1000

Institute for Occupational Safety and Health (NIOSH) has a recommended short-term (ceiling) exposure limit for ozone of 0.1 ppm.[24] Additionally, federal regulations specify 0.05 ppm as the maximum acceptable level of ozone accumulation for medical devices intended for use in human-occupied enclosed spaces.[25]

Given these limits, many ozone treatment devices intended to kill bacteria or viruses on the surfaces of articles and in air incorporate mitigation systems designed to maintain acceptable ozone concentrations in the larger ambient environment. This is often accomplished by producing microbicidal concentrations of ozone within a segregated exposure chamber where the antimicrobial treatment occurs. Residual ozone present following the treatment is then catalytically converted to O_2 prior to being exhausted from the device.

4. Efficacy of Ozone Against Bacteria and Viruses

Ozone is well known for its ability to kill a wide variety of microorganisms. The efficacy of ozone as an antimicrobial is related to various factors such as contact time, ambient temperature, relative humidity (RH), and ozone concentration, and the United States Food and Drug Administration (FDA) requires that medical devices intended to kill microorganisms generate ozone at concentrations of 0.05 ppm or higher (21 C.F.R 801.415), although ambient ozone concentrations must remain below this value for devices used in human-occupied enclosed spaces. Ozone is generally considered more efficacious against microorganisms at higher concentrations and contact times, and at higher RH values. The efficacy of ozone can vary between types of microorganisms as well.[26] Select studies demonstrating the efficacy of ozone for the killing of bacteria and the inactivation of various viruses are summarized below.

Bacteria: Ozone kills bacteria through several mechanisms including the oxidation of enzymes and other proteins, lipoproteins, and lipopolysaccharides, among other biomolecules.[27] This combined activity inactivates the functionality of these biomolecules, increases cell permeability, and can result in the wholescale lysis of bacterial cells. It has been reported that

[24] United States Department of Health and Human Services. (1994). Documentation for Immediately Dangerous to Life or Health Concentrations (IDLHs).
[25] 21 C.F.R. § 801.415
[26] Cristiano L. (2020). Could ozone be an effective disinfection measure against the novel coronavirus (SARS-CoV-2)?. Journal of preventive medicine and hygiene, 61(3), E301–E303. https://doi.org/10.15167/2421-4248/jpmh2020.61.3.1596
[27] Wysok, Beata, Jan Uradziński, and M. Gomólka-Pawlicka. "Ozone as an alternative disinfectant-a review." Polish Journal of Food and Nutrition Sciences 15.1 (2006): 3.

Gram negative bacteria are typically more sensitive to ozonation than Gram positive bacteria, although both of these physiological groupings can be killed by ozone.[28]

Many scientific publications describe the antibacterial effect of ozone under various use conditions. For example, Moore *et al.* reported that gaseous ozone at concentrations of 2 and 5 ppm could kill ≥ 99% of the bacterial pathogens *Escherichia coli, Serratia liquefaciens, Staphylococcus aureus,* and *Listeria innocua* on stainless steel coupons following a 1-hour exposure.[29] In this same study, ozone was also capable of killing *Rhodotorula rubra*, although to a somewhat lesser degree. Gaseous ozone has also been shown to kill significant quantities of *Escherichia coli* and *Bacillus subtilis* bacteria inoculated and dried onto semi-solid agar plates at contact times ranging from 60 to 150 minutes.[30] Gaseous ozone at low concentrations (0.2 ppm) were also shown capable of killing > 99% of bacterial biofilms of *Pseudomonas fluorescens, Staphylococcus aureus,* and *Listeria monocytogenes* following 60 minutes of exposure.[31] Notably, bacterial biofilms are typically considered more resistant to germicidal chemicals than individual planktonic bacteria. In a study of the effect of gaseous ozone on eight different bacteria immobilized on membrane filters, it was observed that 1 hour of exposure to 0.4-0.5 ppm ozone resulted in 99% reduction in all bacterial species tested (*Staphylococcus epidermidis, Micrococcus luteus, Arthrobacter citreus, Bacillus subtilis, Escherichia coli, Salmonella typhimurium, Serratia marcescens,* and *Pseudomonas fluorescens*).[32]

Viruses: In addition to its bactericidal activity, ozone is well-known to inactivate viruses via several mechanisms of action. The antiviral activity of ozone is thought to be largely due to oxidative degradation of the viral lipid envelope (where applicable), proteins, and nucleic acids (*i.e.,* DNA or RNA). Generally speaking, enveloped viruses are considered more vulnerable to inactivation by ozone or other chemicals than non-enveloped viruses.[33,34] Nevertheless, the

[28] Moore, Ginny, Chris Griffith, and Adrian Peters. "Bactericidal properties of ozone and its potential application as a terminal disinfectant." Journal of food protection 63.8 (2000): 1100-1106.

[29] Moore, Ginny, Chris Griffith, and Adrian Peters. "Bactericidal properties of ozone and its potential application as a terminal disinfectant." Journal of food protection 63.8 (2000): 1100-1106.

[30] Li, C. S., Want, Y. C. (2003). Surface Germicidal Effects of Ozone for Microorganisms. AIHA Journal, 64:4, 533-537, doi: 10.1080/15428110308984851

[31] Marino, Marilena, et al. "Inactivation of foodborne bacteria biofilms by aqueous and gaseous ozone." Frontiers in microbiology 9 (2018): 2024.

[32] Heindel TH, Streib R, Botzenhart K. [Effect of ozone on airborne microorganisms]. Zentralblatt fur Hygiene und Umweltmedizin = International Journal of Hygiene and Environmental Medicine. 1993 Sep;194(5-6):464-480. PMID: 8267833.

[33] Rutala, W.A. et al. (2019). Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008. Update: 2019. United States Centers for Disease Control and Prevention. https://www.cdc.gov/infectioncontrol/guidelines/disinfection/

[34] Grignani, Elena, et al. "Safe and effective use of ozone as air and surface disinfectant in the conjuncture of Covid-19." Gases 1.1 (2021): 19-32.

available scientific literature indicates that both enveloped and non-enveloped viruses are susceptible to inactivation by ozone.

For example, in laboratory testing ambient ozone at concentrations as low as 0.23 and 1.23 ppm have been shown capable of causing at least a 100-fold reduction in the viability of aerosolized bacteriophages and non-enveloped murine norovirus MNV-1 (a human norovirus surrogate), respectively, following 40 minutes of exposure at 85% relative humidity[35]. Tseng and Li demonstrated 99% inactivation of model bacteriophage viruses at 18.4 seconds for ozone concentrations between 1.43 ppm and 5.12 ppm at a RH of 55%.[36] At a RH of 85%, the ozone concentration necessary to achieve the same effect was 1.2-1.7 times lower than those at a RH of 55%. As summarized in Bayarri *et al.,* gaseous ozone at various concentrations and contact times has been shown to substantially reduce populations of aerosolized enveloped and non-enveloped viruses commonly used as human virus surrogates for testing purposes, including feline calicivirus and MS2, T7, ϕ x174, and ϕ6 bacteriophages.[37] Data cited in Bayarri *et al.* also indicates that gaseous ozone can inactivate a number of known viral human pathogens such hepatitis A, herpes simplex 1, influenza A, human coronavirus 229E, Rhinovirus 1A, poliovirus, respiratory syncytial virus, and SARS-CoV-2 on various porous and non-porous surfaces such as glass, carpet, fabric, and plastics. An overview of the virucidal ozone data summarized in Bayarri *et al.* is provided at Attachment A to this document.

Ozone-based air purifying devices, which pass contaminated air through an ozone treatment chamber and then past a catalytic ozone scrubber, have also demonstrated virucidal efficacy. For example, the CerroZone mobile air purification devices was recently tested and found capable of reducing the population of aerosolized MS2 virus by 99% following a single pass-through treatment (treatment residence time of 1.2 seconds). Although the CerroZone device also incorporates a filter which could potentially trap viral particles, comparative testing with non-ozonating units indicated that the vast majority of viral reduction observed was due to ozone treatment. The CerroZone device was also subjected to simulated use testing to evaluate its ability to reduce populations of aerosolized MS2 virus in a sealed treatment chamber measuring 9.1 ft x 9.1 ft x 7.0 ft (total volume = 579.7 ft^3). Results indicated a 99.99% reduction in active MS2 virus counts following a 30 minute treatment time.[38]

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[35] Dubuis, Marie-Eve, et al. "Ozone efficacy for the control of airborne viruses: Bacteriophage and norovirus models." PLoS One 15.4 (2020): e0231164.

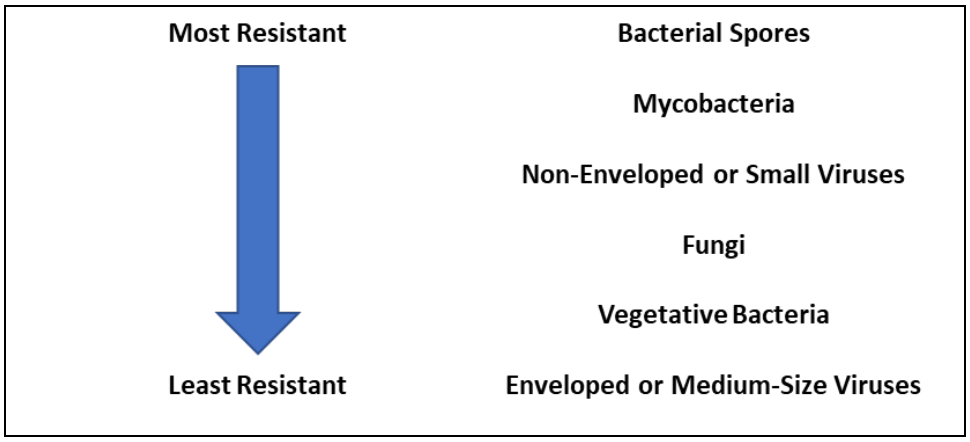
[36] Chun-Chieh Tseng & Chih-Shan Li. (2006). Ozone for Inactivation of Aerosolized Bacteriophages, Aerosol Science and Technology, 40:9, 683-689, doi: 10.1080/02786820600796590

[37] Bayarri, Bernardí, et al. "Can ozone inactivate SARS-CoV-2? A review of mechanisms and performance on viruses." Journal of hazardous materials (2021): 125658.

[38] Aerosol Research and Engineering Laboratories Report "Efficacy of the CerroZone Device Against Aerosolized MS2 Bacteriophage at Various UV Intensity Levels." Olathe KS. 2021.

The CerroZone device is intended to be effective at inactivating the SARS-CoV-2 virus when used in accordance with its labeled instructions for use, and its anticipated efficacy in this regard is supported by the aforementioned MS2 data. Figure 1 below depicts the standard hierarchy of microbial resistance to disinfectant chemicals. Notably, the small, non-enveloped MS2 virus is anticipated to be more resistant to ozone treatment than the enveloped SARS-CoV-2 virus and its present (e.g. delta, omicron) and future variants.

Figure 1: Hierarchy of resistance to chemical germicides[39]



5. Summary and Conclusions

Ozone is a naturally occurring molecule which has been used for over a century to kill microorganisms on surfaces and in environmental media such as water and air. Ozone's efficacy is broad spectrum, and the available data indicate that the chemical can effectively inactivate or kill a wide variety of microorganisms including bacteria, fungi, and viruses. Although ozone can be toxic at high concentrations, the toxicological characteristics of this molecule have been studied extensively and are well-understood. Accordingly, regulatory authorities and other entities in the U.S. have been able to establish guidelines and recommendations to help ensure that ambient ozone concentrations remain at acceptable levels for human exposure.

[39] Adapted from: Favero, M.S. and Bond, W.W.. Chemical Disinfection of Medical and Surgical Materials. In: Disinfection, Sterilization, and Preservation. 5th Ed. Phila: Lippincott Williams & Wilkins 2001: 881-917.

Attachment A: Summary of Virucidal Data Adapted From Bayarri *et al.*

Table A1 – Inactivation of Aerosolized Virus by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	*C.t* (mg. L^{-1}.min)	Medium (virus support)	Log_{10} Reduction (or IR)	Inoculum conditions	RH (%)	Temp. (°C)	Ref.
feline calicivirus	20.00			PBS	2.6			room	(Hudson et al., 2009)
MS2	200	0.0167	0.007	PBS	3.0	buffer sprayed at 2.10^7 PFU/mL	-		(Kekez and Sattar, 1997)
MS2	9000	0.0167	0.294	PBS+ 10% Bovine serum	3	buffer sprayed at 2.10^7 PFU/mL			(Kekez and Sattar, 1997)
MS2	11500	0.0167	0.376	PBS + 25% Bovine Serum	3	buffer sprayed at 2.10^7 PFU/mL			(Kekez and Sattar, 1997)
MS2 HER462	1.13	10.00	0.023	1.24 mm MMAD, buffer+Antifoam A	3.9 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	85	19	(Dubuis et al., 2020)
MS2 HER462	1.13	40.00	0.091	1.24 mm MMAD, buffer+Antifoam A	3.95 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	85	19	(Dubuis et al., 2020)
MS2 HER462	1.13	70.00	0.158	1.24 mm MMAD, buffer+Antifoam A	>4 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	85	19	(Dubuis et al., 2020)
MS2 HER462	1.13	10.00	0.023	1.27 mm, MMAD buffer+Antifoam A	0.75 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	55	19	(Dubuis et al., 2020)
MS2 HER462	1.13	40.00	0.091	1.27 mm, MMAD buffer+Antifoam A	1.9 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	55	19	(Dubuis et al., 2020)
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MS2 HER462	1.13	10.00	0.023	1.10 mm, MMAD buffer+Antifoam A	0.9 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	20	19	(Dubuis et al., 2020)
MS2 HER462	1.13	40.00	0.091	1.10 mm, MMAD buffer+Antifoam A	0.9 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	20	19	(Dubuis et al., 2020)
MS2 HER462	1.13	70.00	0.158	1.10 mm, MMAD buffer+Antifoam A	>4 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	20	19	(Dubuis et al., 2020)

Table A1 – Inactivation of Aerosolized Virus by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	*C.t* (mg. L^{-1}.min)	Medium (virus support)	Log_{10} Reduction (or IR)	Inoculum conditions	RH (%)	Temp. (°C)	Ref.
MS2, ATCC 15597-B1	2.30	0.31	0.001	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	85		(Tseng and Li, 2006)
MS2, ATCC 15597-B1	4.20	0.23	0.002	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	85		(Tseng and Li, 2006)
MS2, ATCC 15597-B1	2.90	0.31	0.002	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	55		(Tseng and Li, 2006)
MS2, ATCC 15597-B1	6.63	0.23	0.003	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	55		(Tseng and Li, 2006)
Murine Norovirus-1 PTA-5935	0.23	10.00	0.005	1.24 mm MMAD, buffer+Antifoam A	0.95 [a]	35 mL buffer sprayed at $3.3.10^5$-$4.4.10^6$ PFU/mL	85	19	(Dubuis et al., 2020)
Murine Norovirus-1 PTA-5935	0.23	40.00	0.018	1.24 mm MMAD, buffer+Antifoam A	2.8 [a]	35 mL buffer sprayed at $3.3.10^5$-$4.4.10^6$ PFU/mL	85	19	(Dubuis et al., 2020)
Murine Norovirus-1 PTA-5935	0.23	70.00	0.032	1.24 mm MMAD, buffer+Antifoam A	3 [a]	35 mL buffer sprayed at $3.3.10^5$-$4.4.10^6$ PFU/mL	85	19	(Dubuis et al., 2020)
Murine Norovirus-1 PTA-5935	0.23	10.00	0.005	1.10 mm, MMAD buffer+Antifoam A	0 [a]	35 mL buffer sprayed at $3.3.10^5$-$4.4.10^6$ PFU/mL	20	19	(Dubuis et al., 2020)
Murine Norovirus-1 PTA-5935	0.23	40.00	0.018	1.10 mm, MMAD buffer+Antifoam A	0 [a]	35 mL buffer sprayed at $3.3.10^5$-$4.4.10^6$ PFU/mL	20	19	(Dubuis et al., 2020)
Murine Norovirus-1 PTA-5935	0.23	70.00	0.032	1.10 mm, MMAD buffer+Antifoam A	0 [a]	35 mL buffer sprayed at $3.3.10^5$-$4.4.10^6$ PFU/mL	20	19	(Dubuis et al., 2020)
PR772 HER221	1.13	10.00	0.023	1.24 mm MMAD, buffer+Antifoam A	2.8 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	85	19	(Dubuis et al., 2020)
PR772 HER221	1.13	40.00	0.091	1.24 mm MMAD, buffer+Antifoam A	>4 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	85	19	(Dubuis et al., 2020)

Table A1 – Inactivation of Aerosolized Virus by Gaseous Ozone

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PR772 HER221	1.13	10.00	0.023	1.27 mm, MMAD buffer+Antifoam A	0.5 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	55	19	(Dubuis et al., 2020)
PR772 HER221	1.13	40.00	0.091	1.27 mm, MMAD buffer+Antifoam A	1.9 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	55	19	(Dubuis et al., 2020)
PR772 HER221	1.13	70.00	0.158	1.27 mm, MMAD buffer+Antifoam A	>4 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	55	19	(Dubuis et al., 2020)
PR772 HER221	1.13	10.00	0.023	1.10 mm, MMAD buffer+Antifoam A	0.4 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	20	19	(Dubuis et al., 2020)
PR772 HER221	1.13	40.00	0.091	1.10 mm, MMAD buffer+Antifoam A	1.6 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	20	19	(Dubuis et al., 2020)
PR772 HER221	1.13	70.00	0.158	1.10 mm, MMAD buffer+Antifoam A	1.1 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	20	19	(Dubuis et al., 2020)
T7, ATCC 11303-B1	3.50	0.31	0.002	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	85		(Tseng and Li, 2006)
T7, ATCC 11303-B1	7.70	0.23	0.003	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	85		(Tseng and Li, 2006)
T7, ATCC 11303-B1	5.12	0.31	0.003	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	55		(Tseng and Li, 2006)
T7, ATCC 11303-B1	10.33	0.23	0.005	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	55		(Tseng and Li, 2006)
ϕ x174	0.04-0.11	35.00	0,0027-0,0076	Distilled water	3.0	6 mL sprayed at $10^{6.5}$ PFU/mL	70		(de Mik and de Groot, 1977)
ϕ x174 HER-036	1.80	6.00	0.0219	water buffer,pH 7.5	2 [b]	1 mL at 10^6-10^7 PFU/mL + 49 mL of phage buffer	80	11-22	(Vyskocil et al., 2020)

Table A1 – Inactivation of Aerosolized Virus by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	*C.t* (mg. L^{-1}.min)	Medium (virus support)	Log_{10} Reduction (or IR)	Inoculum conditions	RH (%)	Temp. (°C)	Ref.
ϕ x174 HER-036	0.3-1.8	6.00	0,0219-0,0036	water buffer,pH 7.5	<1 [b]	1 mL at 10^6-10^7 PFU/mL + 49 mL of phage buffer	40	11-22	(Vyskocil et al., 2020)
ϕ X174, ATCC 13706-B1	1.60	0.31	0.001	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	85		(Tseng and Li, 2006)
ϕ X174, ATCC 13706-B1	2.50	0.23	0.001	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	85		(Tseng and Li, 2006)
ϕ X174, ATCC 13706-B1	1.90	0.31	0.001	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	55		(Tseng and Li, 2006)
ϕ X174, ATCC 13706-B1	3.84	0.23	0.002	Deionized water, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	55		(Tseng and Li, 2006)
ϕ X174, HER36	1.13	10.00	0.023	1.24 mm MMAD, buffer+Antifoam A	3.8 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	85	19	(Dubuis et al., 2020)
ϕ X174, HER36	1.13	40.00	0.091	1.24 mm MMAD, buffer+Antifoam A	>4 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	85	19	(Dubuis et al., 2020)
ϕ X174, HER36	1.13	70.00	0.158	1.24 mm MMAD, buffer+Antifoam A	>4 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	85	19	(Dubuis et al., 2020)
ϕ X174, HER36	1.13	10.00	0.023	1.27 mm, MMAD buffer+Antifoam A	0.8 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	55	19	(Dubuis et al., 2020)
ϕ X174, HER36	1.13	40.00	0.091	1.27 mm, MMAD buffer+Antifoam A	2.8 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	55	19	(Dubuis et al., 2020)
ϕ X174, HER36	1.13	70.00	0.158	1.27 mm, MMAD buffer+Antifoam A	1 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	55	19	(Dubuis et al., 2020)
ϕ X174, HER36	1.13	10.00	0.023	1.10 mm, MMAD buffer+Antifoam A	0.8 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	20	19	(Dubuis et al., 2020)
ϕ X174, HER36	1.13	40.00	0.091	1.10 mm, MMAD buffer+Antifoam A	0.8 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	20	19	(Dubuis et al., 2020)
ϕ X174, HER36	1.13	70.00	0.158	1.10 mm, MMAD buffer+Antifoam A	0.8 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	20	19	(Dubuis et al., 2020)

Table A1 – Inactivation of Aerosolized Virus by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	*C.t* (mg. L^{-1}.min)	Medium (virus support)	Log_{10} Reduction (or IR)	Inoculum conditions	RH (%)	Temp. (ºC)	Ref.
ϕ6 ATCC 21781-B1	1.20	0.31	0.0007	Deionized water + 0.03% Tween 80, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	85		(Tseng and Li, 2006)
ϕ6 ATCC 21781-B1	2.00	0.23	0.0009	Deionized water + 0.03% Tween 80, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	85		(Tseng and Li, 2006)
ϕ6 ATCC 21781-B1	1.43	0.31	0.0009	Deionized water + 0.03% Tween 80, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	55		(Tseng and Li, 2006)
ϕ6 ATCC 21781-B1	2.50	0.23	0.0011	Deionized water + 0.03% Tween 80, 0.5-3 mm diameter	2.0	3L/min at 2.10^8-7.10^8 PFU/mL	55		(Tseng and Li, 2006)
ϕ6 HER102	1.13	10.00	0.023	1.24 mm MMAD, buffer+Antifoam A	0 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	85	19	(Dubuis et al., 2020)
ϕ6 HER102	1.13	40.00	0.091	1.24 mm MMAD, buffer+Antifoam A	>4 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	85	19	(Dubuis et al., 2020)
ϕ6 HER102	1.13	70.00	0.158	1.24 mm MMAD, buffer+Antifoam A	>4 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	85	19	(Dubuis et al., 2020)
ϕ6 HER102	1.13	10.00	0.023	1.27 mm, MMAD buffer+Antifoam A	0.7 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	55	19	(Dubuis et al., 2020)
ϕ6 HER102	1.13	40.00	0.091	1.27 mm, MMAD buffer+Antifoam A	0.4 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	55	19	(Dubuis et al., 2020)
ϕ6 HER102	1.13	70.00	0.158	1.27 mm, MMAD buffer+Antifoam A	1.6 [a]	35 mL buffer sprayed at $4.4.10^6$-10^8 PFU/mL	55	19	(Dubuis et al., 2020)

(a) *This value refers to Relative Infectious ratios (RIR) and it is calculated by dividing mean culture counts (PFU mL^{-1}) with mean qPCR values (genomes mL^{-1}) and then normalized as proposed by Dubuis et al., 2020.*

(b) *This value refers to Corrected Infectious ratios (CIR) and it is calculated by dividing mean culture counts (PFU mL^{-1}) with mean qPCR values (genomes mL^{-1}) and then corrected by calculating the infectious ratio at each time point divided by the infectious ratio at time point 0 as proposed by Vyskocil et al., 2020.*

(c) *CT calculated considering pressure = 1 atm and temperature the one shown in column "T". If T was not provided, it was considered 25ºC*

Table A2 – Inactivation of Viruses on Surfaces by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
Adenovirus (Ad 3,11)	20.00[a]	60	1.800	undetermined	3.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip	40-95	room	(Hudson et al., 2009)
Feline calicivirus	20.00[a]	60	1.800	polystyrene	2.9	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays	70	room	(Hudson et al., 2009)
Feline calicivirus	20.00[a]	60	1.800	polystyrene	0.6	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays	70	room	(Hudson et al., 2009)
Feline calicivirus	20.00[a]	60	1.800	polystyrene	3.9	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays	40-95	room	(Hudson et al., 2009)
Feline calicivirus	20.00[a]	<60	1.800	plastic surface	3.7	0.05-0.1 mL at $1\text{-}2.10^7$ PFU/mL, dried		>70%	<23	(Hudson et al., 2009)
Feline calicivirus	20.00[a]	<60	1.800	Fabric surface	3.0	0.05-0.1 mL at $1\text{-}2.10^7$ PFU/mL, dried		>70%	<23	(Hudson et al., 2009)
Feline calicivirus	20.00[a]	<60	1.800	cotton surface	3.0	0.05-0.1 mL at $1\text{-}2.10^7$ PFU/mL, dried		>70%	<23	(Hudson et al., 2009)
Feline calicivirus	20.00[a]	<60	1.800	carpet surface	4.0	0.05-0.1 mL at $1\text{-}2.10^7$ PFU/mL, dried		>70%	<23	(Hudson et al., 2009)
Feline calicivirus	20.00[a]	60	1.800	undetermined	3.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip	40-95	room	(Hudson et al., 2009)
Feline calicivirus -2280	20	18	0.706	glass surface	4	0.2 mL at $10^{6.87}$ PFU/mL, dried	150 mm round glass Petri plates	80	room	(Cannon et al., 2013)
HCoV-229E Coronavirus	120.00	1	0.235	face mask	3	0.25 mL at $10^{4.5}$ $TCID_{50}$/mL, dried	sprayed on 30x35 mm sample from mask	-	-	(Lee et al., 2020) [c]
HCoV-229E Coronavirus	120.00	5	1.177	face mask	4	0.25 mL at $10^{4.5}$ $TCID_{50}$/mL, dried	sprayed on 30x35 mm sample from mask	-	-	(Lee et al., 2020) [c]
Hepatitis A HM175/18f	5.00	3	0.030	Raspberrys (surface)	0.6	0.05 mL at 10^7 $TCID_{50}$/mL	Raspberrys, stored 20h	52	17	(Brié et al., 2018)
Herpes simplex-1, BC-CDC	20.00[a]	60	1.800	undetermined	3.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip	40-95	room	(Hudson et al., 2009)

Table A2 – Inactivation of Viruses on Surfaces by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
Herpes simplex-1, BC-CDC	28.00[a]	60	2.500	glass surface	~ 2.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip, 25x75mm glass slide	40	20	(Hudson et al., 2009)
Infectious bovine rhinotracheitis virus	0.64	3960	4.972	aqueous layer	3.7	50mL at ~10^8 PFU/mL, liquid	in 11x29cm borosilicate bottles			(Bolton et al., 1982)
Infectious bovine rhinotracheitis virus	0.16	3960	1.243	aqueous layer	0.4	50mL at ~10^8 PFU/mL, liquid	in 11x29cm borosilicate bottles			(Bolton et al., 1982)
Infectious canine hepatitis	0.64	3960	4.972	aqueous layer	1.7	50mL at ~10^8 PFU/mL, liquid	in 11x29cm borosilicate bottles			(Bolton et al., 1982)
Infectious canine hepatitis	0.16	3960	1.243	aqueous layer	0	50mL at ~10^8 PFU/mL, liquid	in 11x29cm borosilicate bottles			(Bolton et al., 1982)
Influenza A (WSN strain)	0.64	1440	1.738	aqueous layer	3.0	50mL at ~10^6 PFU/mL, liquid	in 11x29cm borosilicate bottles			(Bolton et al., 1982)
Influenza A (WSN strain)	0.16	1440	0.435	aqueous layer	1.0	50mL at ~10^6 PFU/mL, liquid	in 11x29cm borosilicate bottles			(Bolton et al., 1982)
Influenza A H1N1 (A/PR/8/34)	10.00	210	4.120	Polystyrene petri dish	4.0	0.1 mL at ~10^7 PFU/mL, dried	60 mm dish, added in drops spread over with micropipette	65	23-29	(Tanaka et al., 2009)
Influenza A H1N1 (A/PR/8/34)	20.00	150	5.886	Polystyrene petri dish	5.0	0.1 mL at ~10^7 PFU/mL, dried	60 mm dish, added in drops spread over with micropipette	65	23-29	(Tanaka et al., 2009)
Influenza A H1N1 (A/PR/8/34)	20.00	600	23.543	Glass petri dish	5.0	0.1 mL at ~10^7 PFU/mL, dried	60 mm dish, added in drops spread over with micropipette	65	23-29	(Tanaka et al., 2009)
Influenza A/WSN/33 H1/N1	20.00	18	0.706	face mask	2.6	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]

Table A2 – Inactivation of Viruses on Surfaces by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
Influenza A/WSN/33 H1/N1	20.00	18	0.706	Tyvek ®	3.0	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	18	0.706	N95 Resp.	4	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	40	1.570	face mask	2.8	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	40	1.570	Tyvek ®	2.8	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	40	1.570	N95 Resp.	3.5	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	face mask	3.0	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	Tyvek ®	4	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	N95 Resp.	4	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	face mask	2.4	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	40	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	Tyvek ®	1.4	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	40	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	N95 Resp.	1.0	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	40	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	face mask	3.5	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	50-70	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	Tyvek ®	3.2	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	50-70	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	N95 Resp.	3.2	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	50-70	24	(Blanchard et al., 2020) [c]

Table A2 – Inactivation of Viruses on Surfaces by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
Influenza A/WSN/33 H1/N1	50.00	40	3.924	face mask	3.5	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	50.00	40	3.924	Tyvek ®	3.5	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	50.00	40	3.924	N95 Resp.	3.5	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	5	0.196	Tyvek	2.0	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	5	0.196	Tyvek	3.4	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	53	48	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	5	0.196	N95 Resp.	2.0	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	5	0.196	N95 Resp.	3.2	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	53	48	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	Bunny suit	2.76	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	PAPR Plastic	3.3	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza A/WSN/33 H1/N1	20.00	90	3.531	PAPR Fabric	3.3	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Influenza H3N2	20.00[a]	60	1.800	polystyrene	2.6	0.1 mL at 10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays	70	room	(Hudson et al., 2009)
Influenza H3N2	20.00[a]	60	1.800	polystyrene	0.1	0.1 mL at 10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays	38	room	(Hudson et al., 2009)
Influenza H3N2	20.00[a]	60	1.800	polystyrene	2.2	0.1 mL at 10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays	40-95	room	(Hudson et al., 2009)
Influenza H3N2	20.00[a]	60	1.800	undetermined	3.0	0.1 mL at 10^6-10^{-9} PFU/mL, dried	spread by sterile tip	40-95	room	(Hudson et al., 2009)

Table A2 – Inactivation of Viruses on Surfaces by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
MS2, ATCC 15597-B1	0.6-1.2	<40	0.105	gelatin	2.0	0.1 mL at 10^8 PFU/mL, dried	gelatin-based medium composed of LB (Luria-Bertani) broth with 7% gelatin.	85		(Tseng and Li, 2008)
MS2, ATCC 15597-B1	0.6-1.2	<40	0.200	gelatin	2.0	0.1 mL at 10^8 PFU/mL, dried	gelatin-based medium composed of LB (Luria-Bertani) broth with 7% gelatin.	55		(Tseng and Li, 2008)
Murine coronavirus	20.00[a]	60	1.800	undetermined	3.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip	40-95	room	(Hudson et al., 2009)
Murine Hepatitis Virus	200.00	90	35.315	glass (dry s.)	>3,2	0.025 mL	lyophilized sample 0.5% gelation, 10% FCS	80	22-25	(Sato et al., 1990)
Murine Hepatitis Virus	300.00	60	35.315	glass (dry s.)	3	0.025 mL	lyophilized sample 0.5% gelatin, 10% FCS	80	22-25	(Sato et al., 1990)
murine norovirus	20.00	18	0.706	glass surface	4	0.2 mL at $10^{7.71}$ PFU/mL, dried	150 mm round glass Petri plates	80	room	(Cannon et al., 2013)
Murine Norovirus-1	40.78	10	0.800	1 ml water in weighing boats	4.1	1 mL at 10^6	small hexagonal weigh boats		25	(Predmore et al., 2015)
Murine Norovirus-1	40.78	20	1.600	1 ml water in weighing boats	4.2	1 mL at 10^6	small hexagonal weigh boats		25	(Predmore et al., 2015)
Murine Norovirus-1	40.78	30	2.400	1 ml water in weighing boats	6.8	1 mL at 10^6	small hexagonal weigh boats		25	(Predmore et al., 2015)
Murine Norovirus-1	40.78	40	3.200	1 ml water in weighing boats	9.1	1 mL at 10^6	small hexagonal weigh boats		25	(Predmore et al., 2015)
Murine Norovirus-1	40.78	10	0.800	strawberrys	3.3	1 mL at 10^6	spread out by pipette, <50 g piece		25	(Predmore et al., 2015)

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Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
Murine Norovirus-1	40.78	40	3.200	strawberrys (inside)	1.5	1 mL at 10^6	injected via syringe and 21 ½ gauge needle		25	(Predmore et al., 2015)
Murine Norovirus-1	40.78	30	2.400	lettuce	2.7	1 mL at 10^6	spread out by pipette, <20 cm^2 piece		25	(Predmore et al., 2015)
Murine Norovirus-1 S99	4.00	2	0.016	Raspberrys	3,3	0.05 mL at 10^7 $TCID_{50}$/mL	Raspberrys, stored 20h	52	17	(Brié et al., 2018)
Murine Norovirus-1 S99	3.00	1	0.006	Raspberrys	3,3	0.05 mL at 10^7 $TCID_{50}$/mL	Raspberrys, stored 20h	52	17	(Brié et al., 2018)
Murine Norovirus-1 S99	1.00	3	0.006	Raspberrys	1.8	0.05 mL at 10^7 $TCID_{50}$/mL	Raspberrys, stored 20h	52	17	(Brié et al., 2018)
P22 bacteriophage ATCC® 19585 -B1™	25.00	150	7.357	N95 Resp.	6.43	0.1 mL at 10^8 PFU/mL, dried	2.5x2.5cm of fabric (masks)		room	(Dave et al., 2020) [c]
Poliovirus	28.00[a]	60	2.500	glass surface	~ 2	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip, 25x75mm glass slide	40	20	(Hudson et al., 2009)
Poliovirus	20.00[a]	60	1.800	polystyrene	2.9	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays	70	room	(Hudson et al., 2009)
Poliovirus	20.00[a]	60	1.800	polystyrene	0.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays	38	room	(Hudson et al., 2009)
Poliovirus	20.00[a]	60	1.800	undetermined	3.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip	40-95	room	(Hudson et al., 2009)
Poliovirus type I Sabin vaccine	0.64	3960	4.972	aquos layer	0.0	50mL at ~10^8 PFU/mL, liquid	in 11x29cm borosilicate bottles	37		(Bolton et al., 1982)
Poliovirus type I Sabin vaccine	0.16	3960	1.243	aquos layer	0.0	50mL at ~10^8 PFU/mL, liquid	in 11x29cm borosilicate bottles	37		(Bolton et al., 1982)
Reo type 3 virus	300.00	240	141.258	plastic (wet s.)	3.0	0.1 mL	35 mm plastic dish = 0.1 mm thickness liquid (0.5% gelatin, 10% FCS)	80	20-23	(Sato et al., 1990)

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Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
Respiratory syncytial virus A2	20.00	90	3.531	Tyvek ®	4	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Respiratory syncytial virus A2	20.00	90	3.531	N95 Resp.	4	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Respiratory syncytial virus A2	20.00	40	1.570	Tyvek ®	4	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Respiratory syncytial virus A2	20.00	40	1.570	N95 Resp.	4	0.05 mL at 10^5 PFU/mL, dried	1 cm x 1 cm fabric sample swatches	80	24	(Blanchard et al., 2020) [c]
Rhinovirus 1A and 14	28.00*	60	2.500	glass surface	~ 2	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip, 25x75mm glass slide	40	20	(Hudson et al., 2009)
Rhinovirus 1A and 14	20.00[a]	60	1.800	undetermined	3.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip	40-95	room	(Hudson et al., 2009)
SARS-CoV-2	10000	0.500	9.810	PPE gown	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	10000	0.500	9.810	face mask	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	4000	0.500	3.924	PPE gown	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	4000	0.500	3.924	face mask	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	4000	1.000	7.848	PPE gown	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	4000	1.000	7.848	face mask	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	4000	5.000	39.238	PPE gown	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	4000	5.000	39.238	face mask	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)

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Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
SARS-CoV-2	2000	1.000	3.924	PPE gown	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	2000	1.000	3.924	face mask	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	2000	5.000	19.619	PPE gown	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	2000	5.000	19.619	face mask	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	2000	10.000	39.238	PPE gown	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	2000	10.000	39.238	face mask	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	2000	10.000	39.238	PPE gown	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	2000	10.000	39.238	face mask	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	1000	10.000	19.619	PPE gown	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	1000	10.000	19.619	face mask	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	500	10.000	9.810	PPE gown	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	500	10.000	9.810	face mask	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	53-65	22	(Clavo et al, 2020)
SARS-CoV-2	8-12	30.000	0.589	PPE gown	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	63	22	(Clavo et al, 2020)
SARS-CoV-2	8-12	30.000	0.589	face mask	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	63	22	(Clavo et al, 2020)

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Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
SARS-CoV-2	8-12	50.000	0.981	PPE gown	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	63	22	(Clavo et al, 2020)
SARS-CoV-2	8-12	50.000	0.981	face mask	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	63	22	(Clavo et al, 2020)
SARS-CoV-2	4-6.5	30.000	0.324	PPE gown	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	99	22	(Clavo et al, 2020)
SARS-CoV-2	4-6.5	30.000	0.324	face mask	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	99	22	(Clavo et al, 2020)
SARS-CoV-2	4-6.5	50.000	0.540	PPE gown	RNA undetected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	99	22	(Clavo et al, 2020)
SARS-CoV-2	4-6.5	50.000	0.540	face mask	RNA detected[b]	0.01 mL at 10^6 copies/mL	10x20 mm samples cut from material	99	22	(Clavo et al, 2020)
SARS-CoV-2 (JPN/TY/WK-521) strain	1	60.000	0.118	stainless steel	1.5	0.05 mL at $8.5.10^5$ PFU/mL, dried	3 cm^2 stainless steel plates	60-80	25	(Yano et al., 2020)
SARS-CoV-2 (JPN/TY/WK-521) strain	6	55.000	0.647	stainless steel	3.3	0.05 mL at $8.5.10^5$ PFU/mL, dried	3 cm^2 stainless steel plates	60-80	25	(Yano et al., 2020)
Sendai virus	200.00	60	23.823	glass (dry s.)	3,7	0.025 mL	lyophilized sample 0.5% gelation, 10% FCS	80	22-25	(Sato et al., 1990)
Sendai virus	200.00	30	11.911	glass (dry s.)	3.7	0.025 mL	lyophilized sample 0.5% gelation, 10% FCS	80	22-25	(Sato et al., 1990)
Sendai virus	200.00	180	71.469	glass (dry s.)	0.9	0.025 mL	lyophilized sample 0.5% gelation, 10% FCS	50	22-25	(Sato et al., 1990)
Sendai virus	300.00	120	71.469	plastic (wet s.)	5.5	0.1 mL	35 mm plastic dish = 0.1 mm thickness liquid (0.5% gelatin, 10% FCS)	80	22-25	(Sato et al., 1990)
Sendai virus	300.00	60	35.734	plastic (wet s.)	3.0	0.1 mL	35 mm plastic dish = 0.1 mm thickness liquid (0.5% gelatin, 10% FCS)	80	22-25	(Sato et al., 1990)

Table A2 – Inactivation of Viruses on Surfaces by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
Sindbis virus	20.00[a]	60	1.800	plastic	4.1	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays, bovine serum albumin 1:1	90	room	(Hudson et al., 2009)
Sindbis virus	20.00[a]	60	1.800	plastic	4.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays, human serum 1:1	90	room	(Hudson et al., 2009)
Sindbis virus	20.00[a]	60	1.800	plastic	4.9	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays, human blood 1:1	90	room	(Hudson et al., 2009)
Sindbis virus	20.00[a]	60	1.800	plastic	3.8	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	lids of sterile polystyrene tissue culture trays	90	room	(Hudson et al., 2009)
Sindbis virus	20.00[a]	60	1.800	undetermined	3.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip	40-95	room	(Hudson et al., 2009)
T7, ATCC 11303-B1	0.6-1.2	<40	0.190	gelatin	2.0	0.1 mL at 10^8 PFU/mL, dried	gelatin-based medium composed of LB (Luria-Bertani) broth with 7% gelatin.	85		(Tseng and Li, 2008)
T7, ATCC 11303-B1	0.6-1.2	<40	0.230	gelatin	2.0	0.1 mL at 10^8 PFU/mL, dried	gelatin-based medium composed of LB (Luria-Bertani) broth with 7% gelatin.	55		(Tseng and Li, 2008)
Theilers' Murine encephalomielitis virus	200.00	180	71.469	glass (dry s.)	3,5	0.025 mL	lyophilized sample 0.5% gelation, 10% FCS	80	22-25	(Sato et al., 1990)
Theilers' Murine encephalomielitis virus	100.00	180	35.734	glass (dry s.)	0.5	0.025 mL	lyophilized sample 0.5% gelation, 10% FCS	70	22-25	(Sato et al., 1990)
Theilers' Murine encephalomielitis virus	300.00	120	71.469	plastic (wet s.)	3.0	0.1 mL	35 mm plastic dish = 0.1 mm thickness liquid (0.5% gelatin, 10% FCS)	80	22-25	(Sato et al., 1990)

Table A2 – Inactivation of Viruses on Surfaces by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
Theilers' Murine encephalomielitis virus	300.00	240	142.937	plastic (wet s.)	>5	0.1 mL	35 mm plastic dish = 0.1 mm thickness liquid (0.5% gelatin, 10% FCS)	80	22-25	(Sato et al., 1990)
Theilers' Murine encephalomielitis virus	300.00	180	107.203	glass (dry s.)	4.2	0.025 mL	lyophilized sample 0.5% gelation, 10% FCS	80	22-25	(Sato et al., 1990)
Theilers' Murine encephalomielitis virus	200.00	180	71.469	glass (dry s.)	3.6	0.025 mL	lyophilized sample 0.5% gelation, 10% FCS	80	22-25	(Sato et al., 1990)
Theilers' Murine encephalomielitis virus	100.00	180	35.734	glass (dry s.)	3.2	0.025 mL	lyophilized sample 0.5% gelation, 10% FCS	80	22-25	(Sato et al., 1990)
Tulane virus	40.78	10	0.800	1 ml water in weighing boats	0.5	1 mL at 10^6	small hexagonal weigh boats		25	(Predmore et al., 2015)
Tulane virus	40.78	20	1.600	1 ml water in weighing boats	1.1	1 mL at 10^6	small hexagonal weigh boats		25	(Predmore et al., 2015)
Tulane virus	40.78	30	2.400	1 ml water in weighing boats	2.9	1 mL at 10^6	small hexagonal weigh boats		25	(Predmore et al., 2015)
Tulane virus	40.78	40	3.200	1 ml water in weighing boats	4.2	1 mL at 10^6	small hexagonal weigh boats		25	(Predmore et al., 2015)
Tulane virus	40.78	30	2.400	strawberrys	4.2	1 mL at 10^6	spread out by pipette, <50 g piece		25	(Predmore et al., 2015)

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Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
Tulane virus	40.78	40	3.200	strawberrys (inside)	1.8	1 mL at 10^6	injected via syringe and 21 ½ gauge needle		25	(Predmore et al., 2015)
Tulane virus	40.78	10	0.800	lettuce	2.3	1 mL at 10^6	spread out by pipette, <20 cm^2 piece		25	(Predmore et al., 2015)
Vaccinia virus	20.00[a]	60	1.800	undetermined	3.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip	40-95	room	(Hudson et al., 2009)
Vesicular stomatitis virus	20.00[a]	60	1.800	undetermined	3.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip	40-95	room	(Hudson et al., 2009)
Vesicular stomatitis virus	0.64	1320	1.593	aqueous layer	4.0	50mL at ~10^9 PFU/mL, liquid	in 11x29cm borosilicate bottles		37	(Bolton et al., 1982)
Vesicular stomatitis virus	0.16	1320	0.398	aqueous layer	1.9	50mL at ~10^9 PFU/mL, liquid	in 11x29cm borosilicate bottles		37	(Bolton et al., 1982)
Yellow fever virus	20.00[a]	60	1.800	undetermined	3.0	0.1 mL at 1.10^6-10^{-9} PFU/mL, dried	spread by sterile tip	40-95	room	(Hudson et al., 2009)
ϕ X174 ATCC 13706-B1	0.6-1.2	<40	0.066	gelatin	2.0	0.1 mL at 10^8 PFU/mL, dried	gelatin-based medium composed of LB (Luria-Bertani) broth with 7% gelatin.	55		(Tseng and Li, 2008)
ϕ X174 ATCC 13706-B1	0.6-1.2	<40	0.053	gelatin	2.0	0.1 mL at 10^8 PFU/mL, dried	gelatin-based medium composed of LB (Luria-Bertani) broth with 7% gelatin.	85		(Tseng and Li, 2008)
ϕ6 ATCC 21781-B1	0.6-1.2	<40	0.059	gelatin	2.0	0.1 mL at 10^8 PFU/mL, dried	gelatin-based medium composed of LB (Luria-Bertani) broth with 7% gelatin.	55		(Tseng and Li, 2008)
ϕ6 ATCC 21781-B1	0,6-1,2	<40	0.050	gelatin	2.0	0.1 mL at 10^8 PFU/mL, dried	gelatin-based medium composed of LB (Luria-	85		(Tseng and Li, 2008)

Table A2 – Inactivation of Viruses on Surfaces by Gaseous Ozone

Virus	[O3] (ppm)	Time (min)	CT^d (mg. L^{-1}.min)	Medium (virus support)	log_{10} Reduction	Inoculum conditions	Sample surface	RH (%)	Temp. (°C)	Ref.
							Bertani) broth with 7% gelatin.			

(a) [O_3] starting at zero, ozonator was switched on at t=0 and [O_3] was increased for about 15' during the experiment up to the desired concentration value, shown in the table.

(b) Virus presence was determined by RT-PCR so quantification was not possible and only virus detection or not detection is provided.

(c) These references refer to preprints articles and have not been peer-reviewed yet.

(d) CT calculated considering pressure = 1 atm and temperature the one shown in column "T". If T was not provided, it was considered 25°C

Attachment A References

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