

UV ROOM

- ✓ **Luz ultravioleta-C**
de alta potência
- ✓ **Reduz mais de 99%** da contaminação
do ar e de superfícies
- ✓ Ideal para ambientes
com rotatividade de pessoas



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O UV ROOM foi projetado para fazer a desinfecção do ar e da superfície de diversos ambientes. O equipamento utiliza luz ultravioleta C (UV-C, com 254 nm) para o procedimento de desinfecção. O acionamento ocorre por meio de controle remoto, o que traz facilidade e permite programar a duração da desinfecção, conforme as dimensões do local, ou até mesmo automatizar o processo.

Para trazer maior segurança aos usuários, há um sistema sonoro para sinalizar quando a desinfecção será iniciada. Além disso, o equipamento possui um sistema redundante de segurança para detecção de movimento através de sensores de micro-ondas e infravermelho. Caso um dos sensores detecte a presença de pessoas ou animais, a lâmpada germicida é desligada automaticamente. Se um dos sensores de presença for acionado, a lâmpada não poderá ser ligada.

O UV ROOM utiliza lâmpadas emissoras de luz UV-C de alta performance cuja efetividade microbicida é comprovada cientificamente, inclusive contra o novo coronavírus. Assim, é ideal para proporcionar biossegurança para ambientes potencialmente contaminados por microrganismos, tais como hospitais, consultórios, clínicas, salas de reunião, salas de aula, banheiros, elevadores, ambulâncias e similares!

UV ROOM

Características Técnicas

Descrição	Equipamento que pode ser fixado para desinfecção do ar e de superfícies do local
Benefícios	Desinfecção à seco do ambiente em minutos
Segurança	Sistema de sensores redundantes para detecção de presença
Capacidade	Ambientes com até 45 m ²
Manutenção	Troca de lâmpada anual
Tensão	110 Volts
Potência elétrica	50 Watts
Dimensões	6,4 x 8,0 x 73,0 (A x L x P) cm
Peso	700 g
Material	Base de alumínio estrutural com caixas de plástico nas pontas


Dimensionamento para alta performance

O UV ROOM foi projetado para que encontrar alta performance em questão de biossegurança. Para isso, confira a tabela a seguir para dimensionar o tempo de exposição mais adequado conforme a área do ambiente que o UV ROOM será utilizado:

UV ROOM

Tempo necessário	Área desinfectada
30 minutos	12,5 m ²
60 minutos	30 m ²
90 minutos	40 m ²
120 minutos	45 m ²

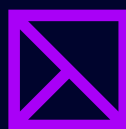
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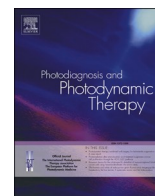
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Tecnologia ultravioleta contra vírus e bactérias

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UV-C (254 nm) lethal doses for SARS-CoV-2

Dear Editor

The rapid and continuous spread of SARS-CoV-2, responsible for COVID-19, has been challenging global health systems and many strategies have been proposed to face the COVID-19 pandemic crisis [1]. In this scenario, ultraviolet lamps emitting ultraviolet C (UV-C) germicidal radiation (peak emission at 254 nm) are in the spotlight to provide efficient and sustainable disinfection of air, liquids and surfaces (e.g., plastics, fabrics, metals, etc). However, UV light with wavelengths greater than 180 nm can cause health adverse effects as eye damage, skin cancer and ageing, and UV-C should be not used in inhabited environments. Herein, we established the inactivation kinetics and reported the UV-C lethal doses (LD) for SARS-CoV-2.

A twenty-four-well plate was seeded with 2×10^5 /mL Vero cells (ATCC CCL-81) for a final volume of 500 μ L/well. Cells were kept in the DMEM High Glucose (DMEM-HG) culture medium (Sigma-Aldrich, USA) supplemented with 10 % bovine fetal serum, 100 units/mL penicillin and 100 μ g/mL streptomycin. Subsequently, the plate was incubated at 37 °C with 5% CO₂ for 24 h, and then the culture medium was completely removed and replaced by 750 μ L of DMEM-HG without supplementation [2,3].

An aliquot of the SARS-CoV-2 stock, previously characterized by Araujo et al. [4], was thawed and 100 μ L were diluted in 900 μ L of DMEM-HG without supplementation. Then, 200 μ L of this dilution were placed in wells of a 24-well plate, which were exposed to the UV-C lamp (UVsurface, Biolambda, Brazil) placed 30 cm above the plate to allow an uniform irradiance over the plate wells (2.2 ± 0.2 mW/cm²). Light was delivered by 2, 30 and 120 s corresponding to doses of 4.4, 66 e 264 mJ/cm², respectively. Controls were not submitted to irradiation.

After exposure to UV-C light, aliquots of 83.4 μ L were placed into the plates containing the previously seeded Vero cells and incubated for 1 h at 37 °C with 5% CO₂ for viral adsorption. Thereafter, 166.6 μ L of DMEM-HG medium containing 12 % fetal bovine serum were added and the plate was incubated for 48 h at 37 °C with 5% CO₂.

After that, 100 μ L of medium from each well was removed and placed into a lysis buffer solution to proceed with the extraction of the viral RNA using the MagMAX™ CORE Nucleic Acid Purification Kit (Thermo Fisher). After extraction, the number of copies of SARS-CoV-2 per mL was obtained using the RT-qPCR technique. Results were normalized in relation to controls for the calculation of viral inhibition rates of each sample. For the viral inactivation kinetics, we used the methodology reported by Sabino et al. [5].

UV-C inactivation kinetics and lethal doses for SARS-CoV-2 are presented at Fig. 1 and Table 1, respectively. We verified that within less than a second, UV-C irradiation was able to inactivate more than 99 % of SARS-CoV-2 viral particles. In fact, LD₉₀ and LD_{99,999} were achieved at 0.016 and 108.714 mJ/cm² (0.01 and 49.42 s) respectively.

In summary, we report the inactivation kinetics and lethal dose analysis of UV-C radiation, emitted by low-pressure mercury lamps at 254 nm, against SARS-CoV-2, in a controlled *in vitro* experiment. Our findings can help scientific community and health authorities to develop safe and effective protocols to reduce the dissemination of SARS-CoV-2 during this global health crisis. Thus, we strongly encourage further studies in more realistic situations.

Declaration of Competing Interest

The authors report no declarations of interest.

Acknowledgments

CPS, RRG and ELD were supported by the São Paulo Research Foundation (FAPESP, grants 2017/22406-0, 2017/24769-2 and 2016/20045-7). CPS and DFSM were supported by the Brazilian National Council for Scientific and Technological Development (CNPq, scholarship 141901/2016-0). FPS thanks Coordination for the Improvement of Higher Education Personnel (CAPES) for his scholarship. MSR thanks the Photonics Institute for financial support (INFO/CNPq grant 465763/2014-6).

References

- [1] N. Zhu, D. Zhang, W. Wang, X. Li, B. Yang, J. Song, et al., China novel coronavirus investigating and research team (2020). A novel coronavirus from patients with pneumonia in China, *N. Engl. J. Med.* 382 (8) (2019) 727–733.
- [2] Y. Shi, D.H. Yang, J. Xiong, J. Jia, B. Huang, Y.X. Jin, Inhibition of genes expression of SARS coronavirus by synthetic small interfering RNAs, *Cell Res.* 15 (2005) 193–200.
- [3] C. Taştan, B. Yurtsever, G. Sir Karakuş, D. Dilek KançaGi, S. Demir, S. Abanuz, et al., SARS-CoV-2 isolation and propagation from Turkish COVID-19 patients, *Turk. J. Biol.* 44 (2020) 192–202.
- [4] D.B. Araujo, R.R.G. Machado, D.E. Amgarten, F.M. Malta, G.G. de Araujo, C.O. Monteiro, et al., SARS-CoV-2 Isolation from the First Reported Patients in Brazil and Establishment of a Coordinated Task Network, *Memórias do Instituto Oswaldo Cruz*, 2020, <https://doi.org/10.1590/0074-02760200342>.

<https://doi.org/10.1016/j.pdpdt.2020.101995>

Received 5 August 2020

Available online 8 September 2020

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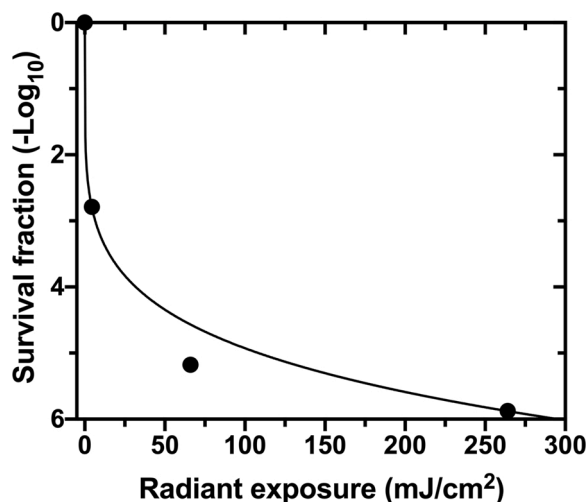


Fig. 1. Inactivation kinetics of SARS-CoV-2 promoted by UV-C radiation at 254 nm.

Table 1

UV-C lethal doses for SARS-CoV-2.

Viral inactivation (%)	UV-C dose (mJ/cm ²)	Exposure time (s)
90	0.016	0.01
99	0.706	0.32
99.9	6.556	2.98
99.99	31.880	14.49
99.999	108.714	49.42

[5] C.P. Sabino, M. Wainwright, C. Dos Anjos, F.P. Sellera, M.S. Baptista, N. Lincopan, M.S. Ribeiro, Inactivation kinetics and lethal dose analysis of antimicrobial blue light and photodynamic therapy, *Photodiagnosis Photodyn. Ther.* 28 (2019) 186–191.

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