Literature review

The effect of UV-C on SARS-CoV-2

Aim of work

The effects of UV-C radiation on SARS-CoV-2 have been thoroughly studied in these past 3 months and a collection of the most relevant litterature is presented below.

The intent of this litterature research has been to assess the efficacy of UV-C light for the proposed application and verify what were present the conditions that may influence the performance of UV-C (surface materials, time, distance, etc.). The final aim of this work, has been to determine a specific UV-C dosage that would guarantee a log 3 reduction of the viral titer.

Microorganism	UV-C frequency	Dose (mJ/cm^2)	Log-reduction	Study	Technology
SARS-CoV-2	280nm	3,75	1-Log	Inagaki et al. (1)	UV-C LED (Nikkiso)
SARS-CoV-2	254nm	3,7	3-Log	Bianco et al. (2)	Mercury lamp (supplier N.A.)
SARS-CoV-2	254nm	5	2-Log	Signify & Boston University (3)	Mercury lamp (Signify)
SARS-CoV-2	254nm	5	1-Log	Patterson et al. (4)	CL1000 UVP Crosslinker
SARS-CoV-2 surrogate	222nm	1	3-Log	Buonanno et al. (5)	Far UV-C lamps, 12 W 222-nm KrCl excimer lamp (USHIO America)

Results & Rational

The above studies have been selected due to their relevance to our work. The aforementioned studies have been performed in different laboratories under different conditions. We have developed our system based on an average of the different doses (mJ/cm2) used in order to confidently obtain a Log-3 reduction of the viral titer.

As shown in the table, the research group lead by Bianco et al. (2) from Milano, have successfully proven that by using 3,7 mJ/cm^2 they have obtained a Log 3 reduction, comparable to a 99.9% reduction of the virus. Their technology and methodology of studies resembles our system which makes us confident about the potential efficacy of our product. However, due to other research studies, we have decided to take a conservative approach and set our products so that they guarantee an applied dose of 10 mJ/cm^2 to ensure a higher level of efficacy also against other types of pathogens.

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References

1) Rapid inactivation of SARS-CoV-2 with Deep-UV LED irradiation

Hiroko Inagaki, Akatsuki Saito, Hironobu Sugiyama, Tamaki Okabayashi, Shouichi Fujimoto

2) UV-C irradiation is highly effective in inactivating and inhibiting SARS-CoV-2 replication

Andrea Bianco, Mara Biasin, Giovanni Pareschi, Adalberto Cavalieri, Claudia Cavatorta, Claudio Fenizia, Paola Galli, Luigi Lessio, Manuela Lualdi, Edoardo Redaelli, Irma Saulle, Daria Trabattoni, Alessio Zanutta, Mario Clerici

3) Signify & Boston University:

https://www.signify.com/global/our-company/news/press-releases/2020/20200616-signify-boston-university-validate-effectiveness-signify-uvc-light-sources-on-inactivating-virus-that-causes-covid19

4) Methods of inactivation of SARS-CoV-2 for downstream biological assays.

Patterson EI, Prince T, Anderson ER, et al. Preprint. bioRxiv. 2020;2020.05.21.108035. Published 2020 May 23. doi:10.1101/2020.05.21.108035

5) Far-UVC light (222 nm) efficiently and safely inactivates airborne human coronaviruses.

Sci Rep 10, 10285 (2020). Buonanno, M., Welch, D., Shuryak, I. et al. https://doi.org/10.1038/s41598-020-67211-2