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Department of Molecular and Developmental Medicine

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Report (version 1.0)

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EVALUATION OF VIRUCIDE ACTIVITY OF UV BOX E 2/40H & UV BOX E 2/40H NX BY LIGHT PROGRESS

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TARGET

It is recognized that UV-C light has the ability to stop microbial and viral growth, its physical approach is considered a good compromise between cost and effectiveness, which is why it is progressively becoming more and more widespread in health care and home.

The correct use of UV-C technology takes the following parameters into account: distance from the light source (m), spatial light distribution, radiant power (W), irradiance (W/sqm), inversely proportional to the square of the distance, and radiation times (min). It allows a deep disinfection of objects that are exposed to an adequate dose of UV-C rays, where the dose (J/sqm) is the product of irradiation time and irradiance. Predictive models, that take into account the parameters described above, make it possible to predict the disinfection capacity of systems based on UV-C technology. In particular, once the dose corresponding to a specific reduction in microbial load has been established, they enable the relative UV-C irradiation times to be predicted for each distance, and viceversa.

The aim of this study is to determine the virucide activity, against the SARS-CoV-2, of the UV-C radiation which occurs in the UV BOX E 2/40H & UV BOX E 2/40H-NX.

UV BOX E 2/40H & UV BOX E 2/40H-NX

Both the devices are produced by Light Progress and differ only for external aesthetic aspects.

The boxes are equipped with two UV-C lamps of 40 W, installed in opposite positions, one on the top and one on the bottom, in order to radiate all surfaces to be disinfected. In addition, the boxes have the internal parts made of mirrored aluminum which increases the reflection of the UV-C light. The box contains a flat stainless-steel grid to support objects which need to be treated and a lid that shields the UV-C light. The UV BOX E 2/40H-NX has steel door with an inner part covered by mirrored aluminum (Figure 1-2) while the model E 2/40H has a window which allows the inspection of the treatment process (Figure 3-4).

Figure 1. UVBOX E 2/40H-NX

Figure 2. UVBOX E 2/40H-NX

Figure 3. UVBOX E 2/40H

Figure 4. UVBOX E 2/40H

PARAMETERS ESTABLISHED FOR THE TESTS

Name of product tested: UV BOX E 2/40H

Period of analysis: 10/06/20 – 13/06/20

Temperature of incubation: 37°C

Identification of Viral strain: SARS-CoV-2 (Lot: VMR –SARSCPV2 VERO E6_28042020)

Incubation period: 3 days

Irradiation time: 2 minutes

Repetition of tests: 3 times

OPERATIVE TECHNIQUE

All repetitions were tested for SARS-CoV-2 concentration by TCID50% using VERO E6 C1008 (ATCC CRL-1586) cell line.

Set-Up

The UV light was activated by closing the lid and pressing the switch button (Figure 5).

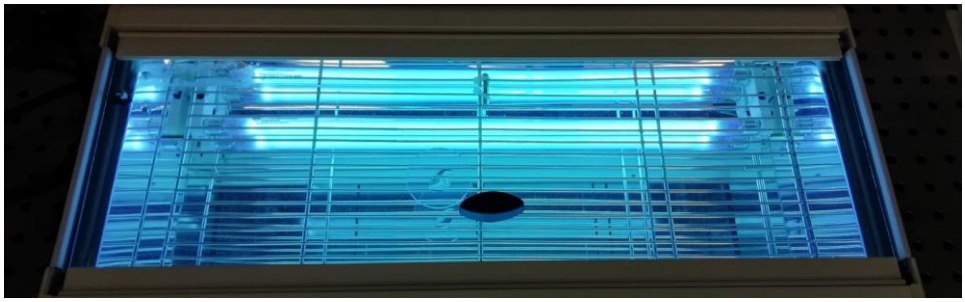


Figure 5. UV light ON (closed lid)

Experiment method

Crystals (UV-C permeable) were positioned in the center on the grid (Figure 6), then inoculated with 100 µL of viral suspension. The suspension virus used was $10^{7.2}$ TCID50%/mL (7.2 expressed by Log_{10}).

Figure 6. Drop spot position on the grid

The surfaces were irradiated by the device for 2 minutes.

Examined samples:

- 3 samples inoculated with viruses and subjected to the action of UV as per protocol;
- 3 samples inoculated but not treated with UV to determine viral titer after recovery and examined immediately after inoculation.

The collected suspensions were used to inoculate a 48-wells plate into which the VERO E6 cell cultures were fixed.

Subsequent decimal dilutions were inoculated for a total of 10 dilutions. Each dilution was inoculated in 4 wells.

The plates were incubated for 3 days at 37°C ±2°C at 5% CO_2 in a humidified atmosphere.

After the exposure time, we tested the residual virus activity by evaluating the Tissue Culture Infective Dose 50% (TCID50%).

Viral titers were determined according to the method developed by Spearman-Karber where percent reduction of virus is determined according to the following formula:

$$[1-(T/C)]*100$$

where:

T = Log_{10} of Virus Test Carrier

C = Log_{10} of Virus Control Carrier

RESULTS

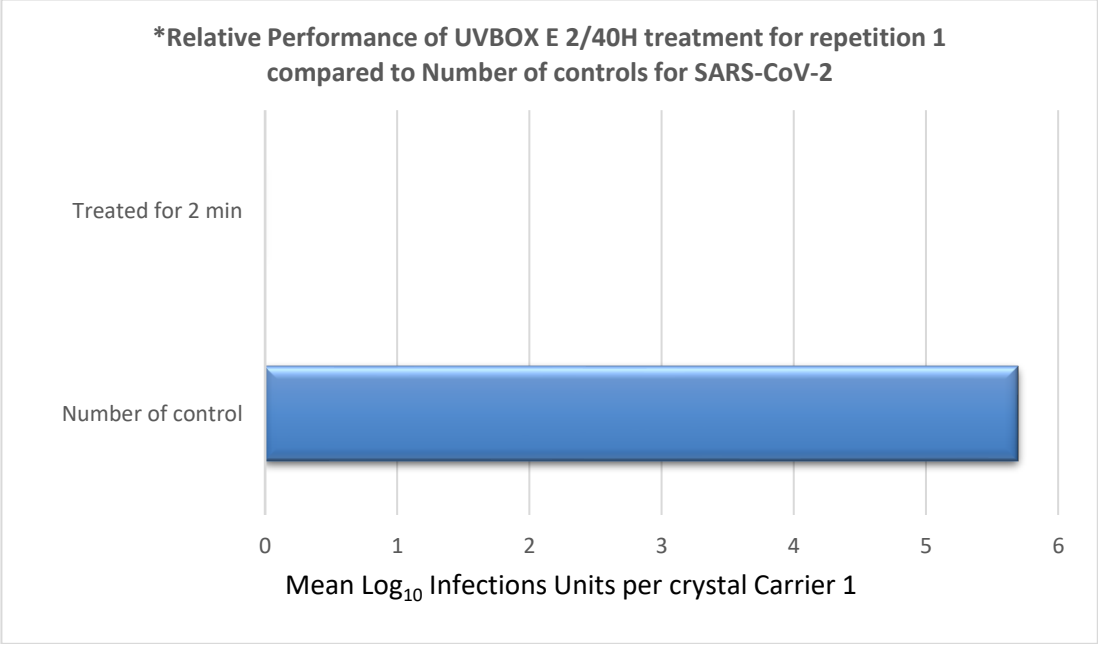
The results are presented in the following table 1 and graphs 1-3.

Table 1

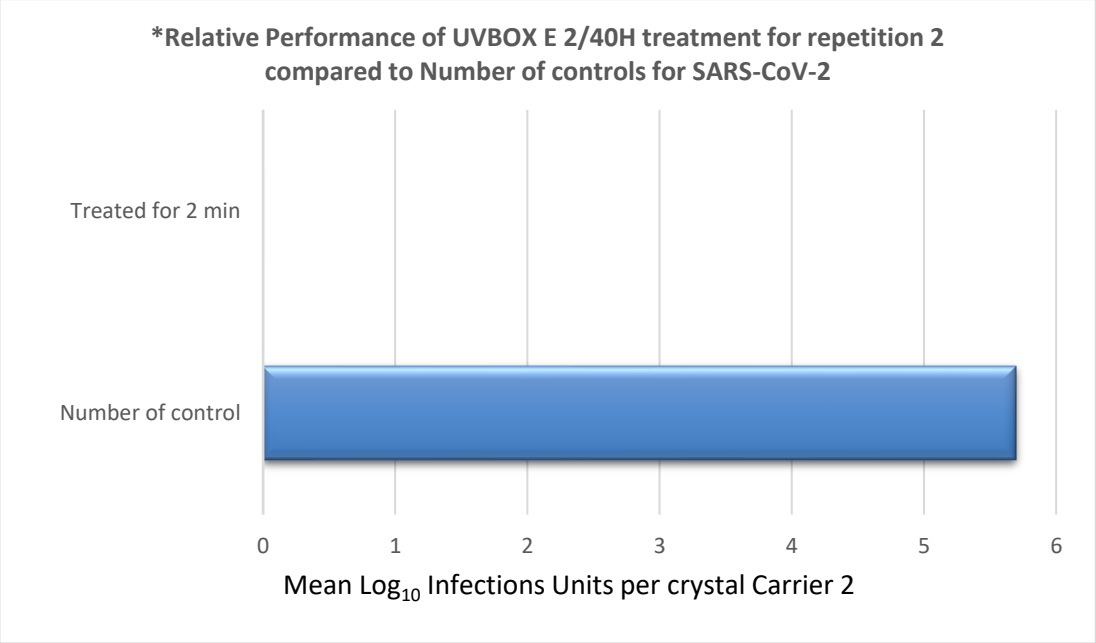
Repetition	Time of exposition	Log suspension virus TCID50%	Log TCID50% after treatment	Log reduction TCID50%
1	2 min	7.2	1.5*	5.7
2	2 min	7.2	1.5*	5.7
3	2 min	7.2	1.5*	5.7

*The value of Log TCID50 = 1.5 means total viral inactivation

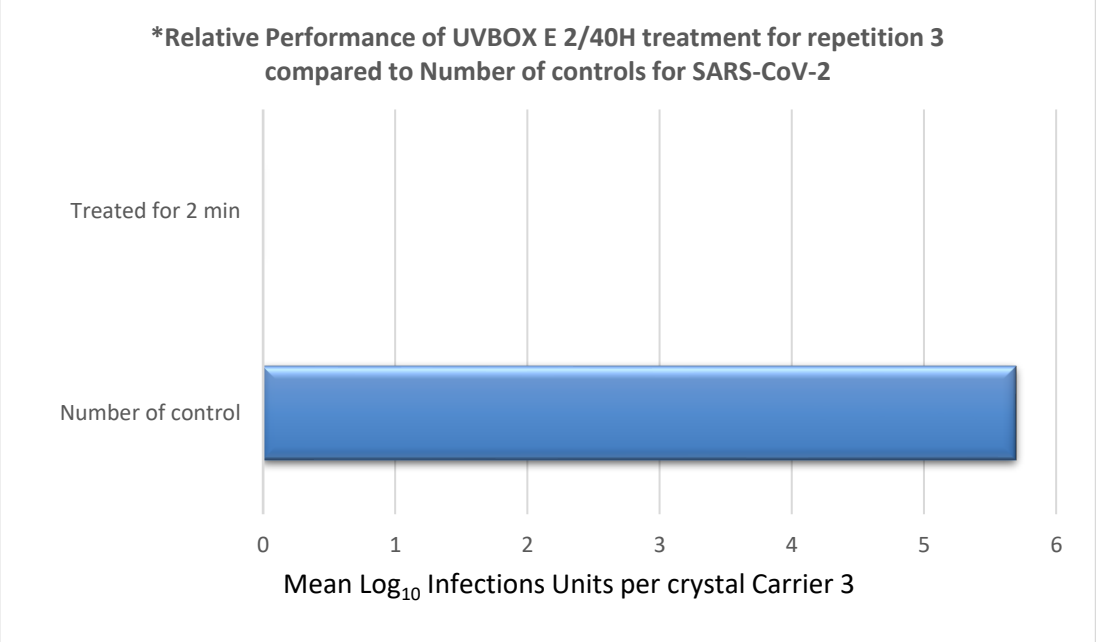
Graph 1



Graph 2



Graph 3



* Viral titers at 1.5 for this test has a value of 0 in the Graphs

DISCUSSION AND CONCLUSIONS

The tests showed that, for the carriers located on the device grids, 5.7 Log_{10} reduction was reached, when tested against SARS – CoV- 2, with an irradiation time of 2 minutes for all the 3 repetitions.

REFERENCES

ZIMBRO, M.J. ET AL., 2009*: DIFCO & BBL MANUAL –MANUAL OF MICROBIOLOGICAL CULTURE MEDIA*- SECOND EDITION

RAMAKRISHNAN, M.A., Determination of 50% endpoint titer using a simple formula, World J Virol. 2016 May 12; 5(2): 85–86.

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