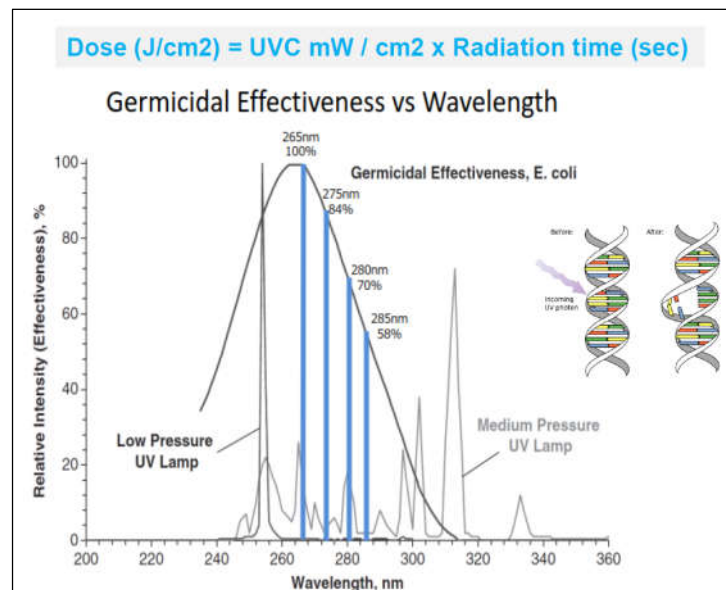


BACKGROUND DOCUMENT ON CORONAVIRUSES

1°) WHAT WAVELENGTH SHOULD BE USED?

The efficacy against germs and viruses is the same between UV LEDs at 275nm and a low-pressure mercury lamp at 254nm (commonly used for disinfecting air or water). The peak absorption of UVs by DNA or RNA being located at 265nm. At this wavelength precisely, the power conversion of the LED being inefficient compared to the available semiconductors, the choice must be made on **275 nm**.



2°) SOURCE REFERENCE FOR THE DOSE TO BE USED AGAINST CORONAVIRUS

The tests on COVID-19 being still in progress, it is considered to date as the average of all the tests carried out on the Coronaviruses already studied and presented below: the dose commonly accepted for destroying the coronaviruses is **67J/m²** or **67W.s/m²** of exposure.

Summary of Ultraviolet Studies on Coronaviruses				
Microbe	D ₉₀ Dose J / m ²	UV k m ² / J	Base Pair kb	Source
Coronavirus	7	0,35120	30741	Walker 2007 ^a
Berne virus (Corona viridae)	7	0,32100	28480	Weiss 1986
Murine Coronavirus (MHV)	15	0,15351	31335	Hirano 1978
Canine Coronavirus (CCV)	29	0,08079	29278	Sanknimit 1988 ^b
Murine Coronavirus (MHV)	29	0,08079	31335	Sanknimit 1988 ^b
SARS Coronavirus CoV-P9	40	0,05750	29829	Duan 2003 ^c
Murine Coronavirus (MHV)	103	0,02240	31335	Liu 2003
SARS Coronavirus (Hanoi)	134	0,01720	29751	Kanwa 2004 ^d
SARS Coronavirus (Urbani)	241	0,00955	29751	Darnell 2004
Average	67	0,03433		

^a (Jingwen 2020) ^b (estimated) ^c (mean estimate) ^d (at 3 lgs)

Source: "2020 COVID-19 Coronavirus Ultraviolet Susceptibility" by Wladyslaw J. Kowalski, Thomas J. Walsh, Vidmantas Petraitis

3°) RELATION BETWEEN DOSE AND EFFICACY OF UV TREATMENT

The tests consist in verifying the destruction of 90% of viruses and bacteria at these exposure levels (D90). The efficacy (of the treatment) depends on the wavelength (in nm) and depends also on the multiplication of the UVc wattage by the exposure's time.

The efficiency is a logarithmic function of reducing the number of germs, viruses or bacteria:

1-log = 90%

2-log = 99%, doubling exposure means increasing efficiency by 10

3-log = 99.9%, tripling the exposure means increasing efficiency by 100

4-log = 99.99%, quadrupling the exposure means increasing efficiency by 1000

It is not necessary to kill microorganisms, damaging their genetic heritage is sufficient to prevent their replication in the case of viruses (the doses can thus remain efficient at a lower level).

However, the indirect exposure must be ignored because the absorption of UVs by surfaces is important. Only the direct exposure must be considered.

4°) APPLICATION TO THE OPTIMO UV-C LEDIZ®, EXPOSURE TIME AND RISKS ON HEALTH

OPTIMO UV-C LEDIZ®:

Puvc: 1W

With 60° cut-off angle of the optics -> exposure on 3.45m x 3.45m at 2m height -> exposure area: 12m²

Irradiance: $1W/3.45 \times 3.45m^2 = 0.08W/m^2$

Time for D90: $t=D/I=67/0.08=837sec$

	D90	D99	D99,9	D99,99
Time (s)	837,5	1675	2512,5	3350
Time (m)	13	27	41	55

Maximum daily "accidental" exposure time: 30s per 1 watt (monochromatic)

The ICNIRP guideline for maximum human biologically efficient radiant exposure of the eye and skin to UVR within an 8 h (30,000 s) period is 30 J/m² effective. If the irradiance is constant, the permissible exposure duration, t_{max} (s) is the ICNIRP exposure limit of 30 J/m² divided by the effective irradiance:

$$t_{max}(s) = (30J / m^2) / E_{eff}(W / m^2)$$