

The UV effect

BlueLight

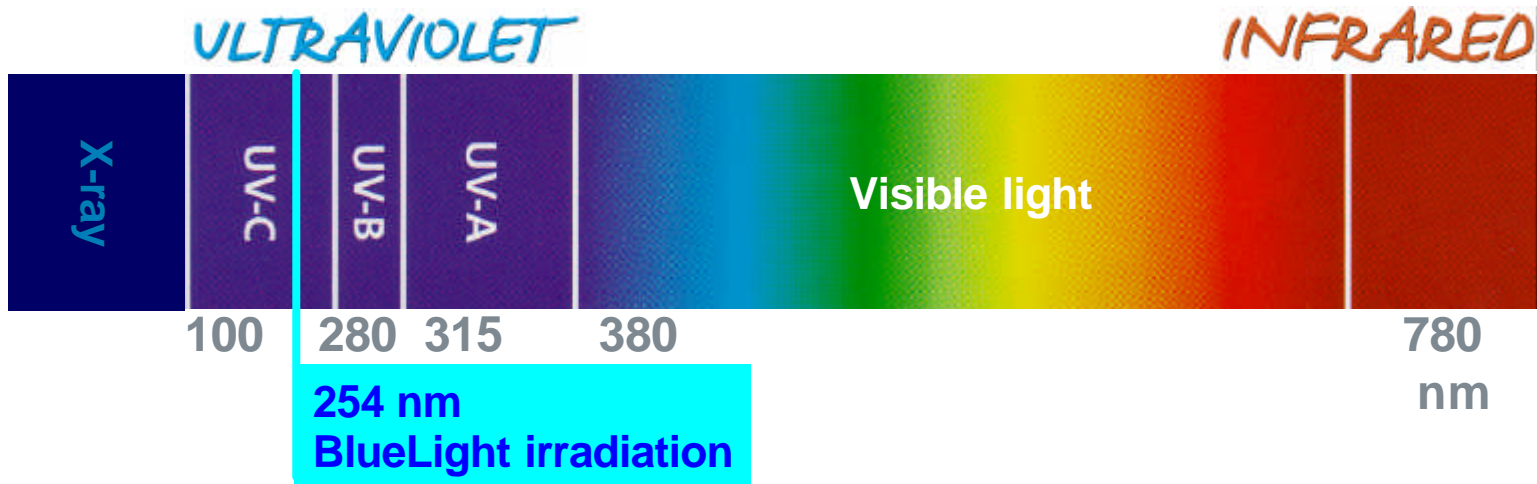
UV-Disinfection Units



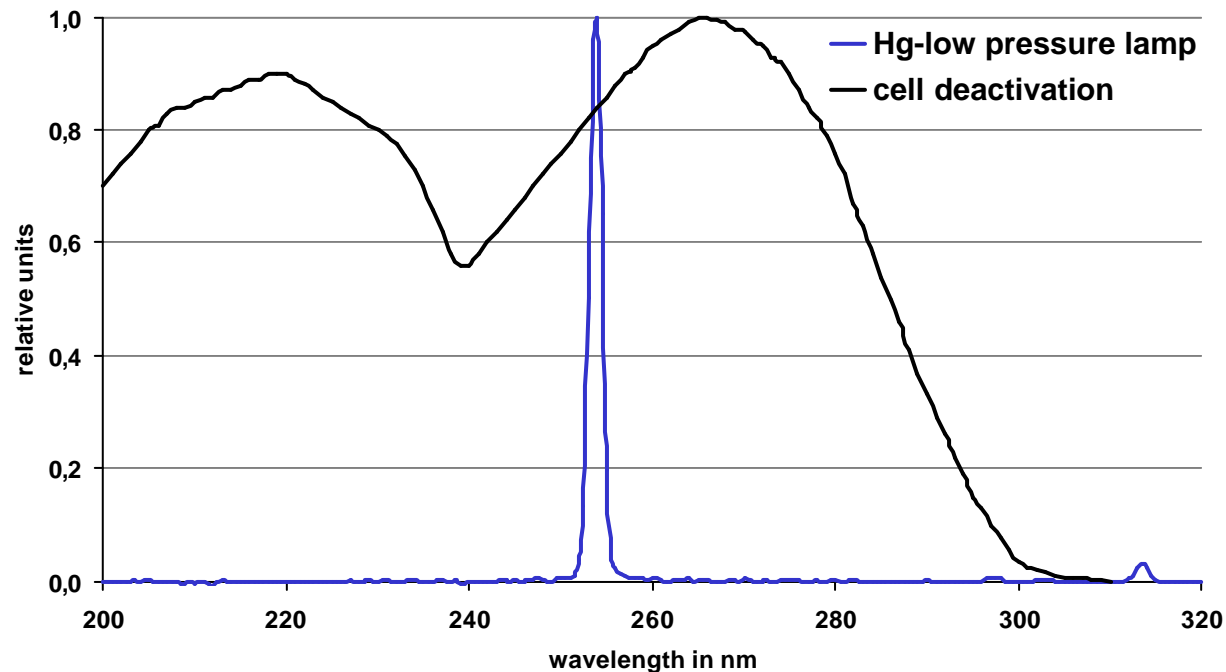
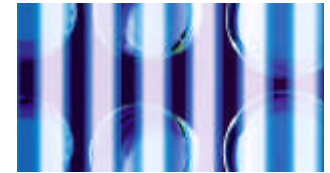
Electromagnetic spectrum



UV radiation is emitted in the wavelength range from 100 to 380 nanometre (nm). BlueLight UVC radiation is emitted at 254 nm.



Emission spectrum of the BlueLight cassette and action spectrum of the inactivation of bacteria cells

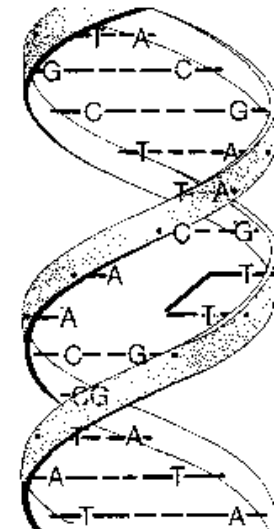


DNA – the target for UVC-irradiation



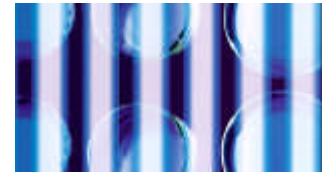
DNA

- High absorption in the UVC-range
- Large macromolecule (see table)
- Contains the complete set of blue prints for all molecules of the cell
- Single copy per cell



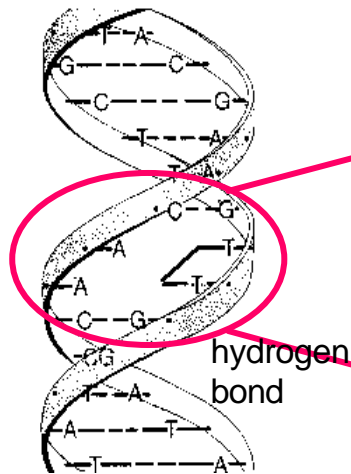
Micro organism	Size of cell	Length of DNA	Number of base pairs
Escherichiacoli (Bacteria)	1µm	1360 µm	4 millions
Saccharomyces cerevisiae (Yeast)	5-10 µm	4600 µm	13,5 millions

Damage of DNA by UVC

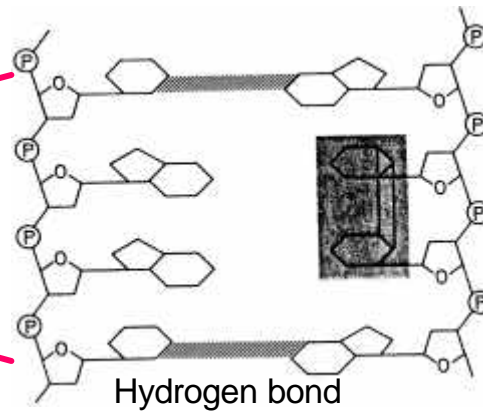


DNA double helix

Thymin dimer
the most important type
of UVC-damage



sugar phosphate backbone



Lethal dose for different bacteria



99,9 % germs inactivation:

BACTERIA	$\left[\frac{mW}{cm^2} \times s \right]$		$\left[\frac{mW}{cm^2} \times s \right]$
Bacillus anthracis	13,7	Pseudomonas aeruginosa	16,5
B. Megatherium sp. (veg.)	3,4	Pseudomonas fluorescens	10,5
B. Megatherium sp. (spores)	8,0	S. typhimurium	24,0
B. paratyphosus	9,6	Sarema lutea	59,0
B. subtilis (spores)	36,0	Serratia marcescens	7,2
Corynebacterium diphtheriae	10,0	Shigella paradysenteriae	5,2
Eberthella typosa	6,3	Spirillum rubrum	13,0
Escherichia coli	9,0	Staphylococcus albus	5,4
Micrococcus candidus	19,0	Staphylococcus aureus	7,8
Micrococcus sphaeroides	30,0	Staphylococcus hemolyticus	6,6
Neisseria catarrhalis	13,0	Staphylococcus lactis	18,0
Phytomonas tumefaciens	13,0	Staphylococcus viridans	6,0
Proteus vulgaris	7,8		

Lethal dose for different yeasts and fungi

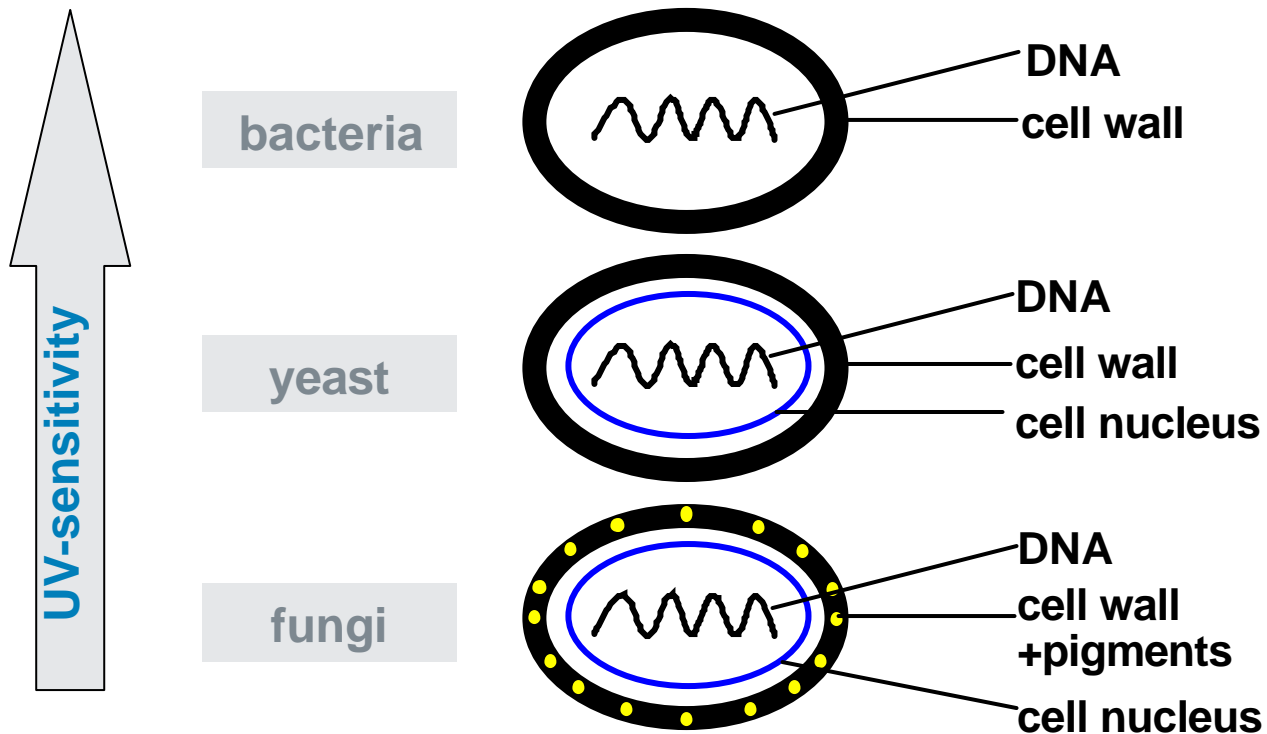
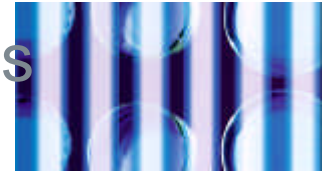


99,9 % germs inactivation: $\left(\frac{mW}{cm^2} \times s \right)$

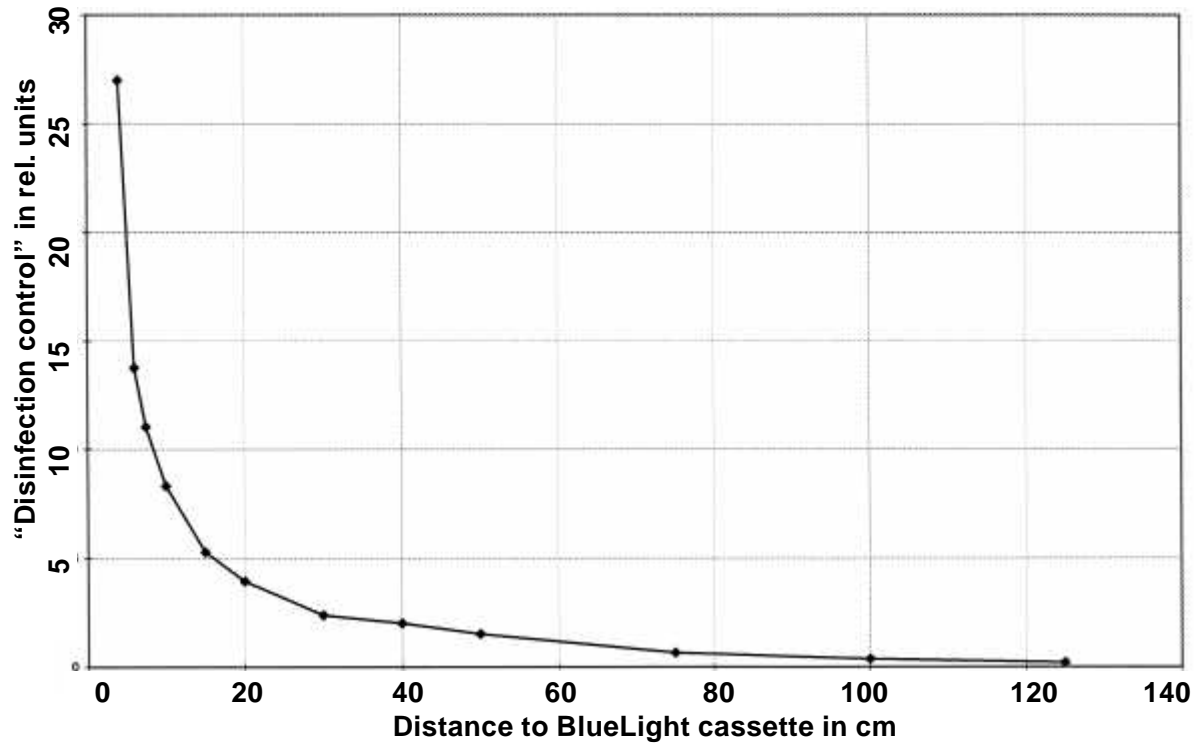
YEASTS	$\left(\frac{mW}{cm^2} \times s \right)$
Saccharomyces ellipsoidens	18,0
Saccharomyces sp.	24,0
Saccharomyces cerevisiae	18,0
Brewing yeast	9,9
Baking yeast	11,7

FUNGI	$\left(\frac{mW}{cm^2} \times s \right)$
Penicillium roqueforti (<i>green</i>)	39,0
Penicillium expansum (<i>olive</i>)	39,0
Penicillium digitatum (<i>olive</i>)	132,0
Aspergillus glaucus (<i>blue-green</i>)	132,0
Aspergillus flavus (<i>yellowish</i>)	180,0
Aspergillus niger (<i>black</i>)	396,0
Rhizopus nigricans (<i>black</i>)	330,0
Mucor racemosus A (<i>light grey</i>)	51,0
Mucor racemosus B (<i>light grey</i>)	51,0
Oospora lactis (<i>white</i>)	15,0

UV-sensitivity of different micro organisms



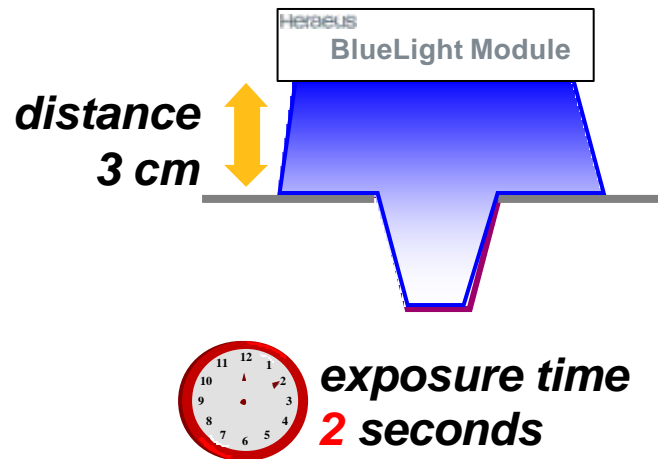
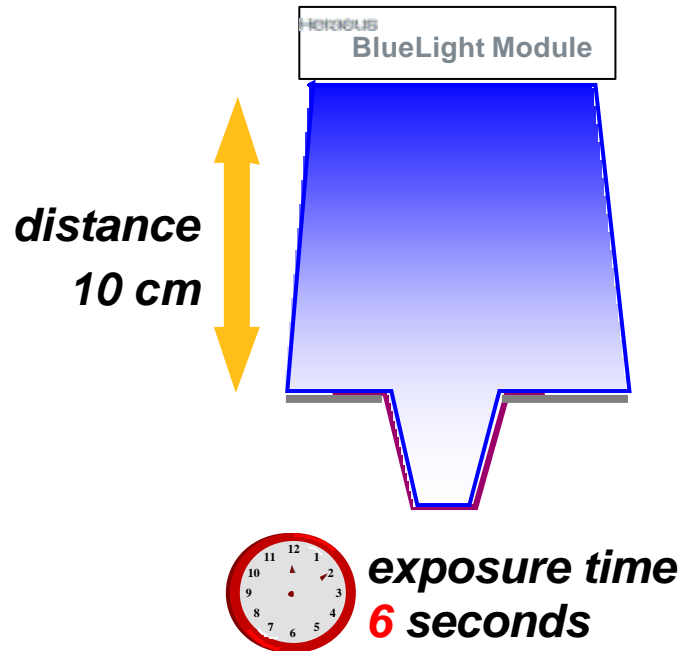
Distance dependency of the irradiance



Time-distance relation



The exposure and disinfection time depends on the distance between BlueLight cassette and material to be disinfected: The greater the distance, the longer the exposure time.

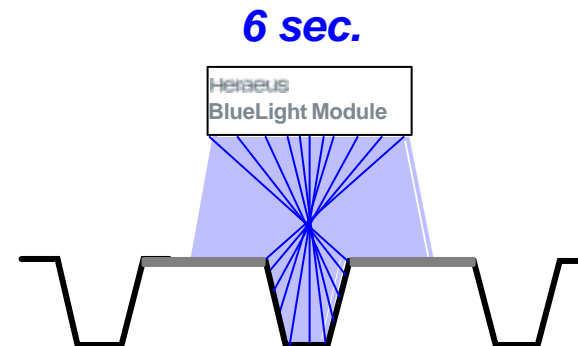


Collecting the lethal dose in the cycle of the machine



Example:

- Required exposure time: 6 seconds
- At a cycle time of 6 seconds
- 1 exposure is sufficient



Example:

- Required exposure time: 6 seconds
- At a cycle time of 2 seconds
- 3 exposures are required

