UVR-M and UVR-Mi,

UV Air Recirculators Test Report

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UV air recirculators **UVR-M** and **UVR-Mi,** produced by Biosan, are equipped with bactericidal UV lamps (Philips) and are used for air disinfection in research laboratories, hospitals and veterinary clinics.

To show the efficiency of UV air recirculators **UVR-M** and **UVR-Mi,** we examined UV intensity in Philips 25W bactericidal UV lamps and an impact of UV radiation on various types of microorganisms.

General information

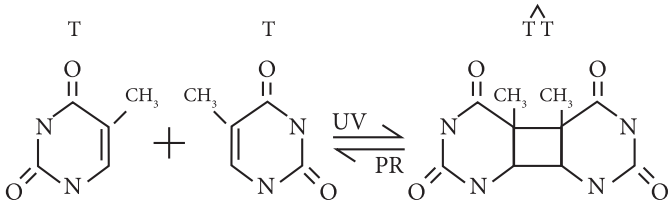
Theory: UV radiation affects the viability of microorganisms by causing photochemical reactions in the structure of DNA and RNA. Adjacent pyrimidine molecules form dimers and block the reproduction of bacteria, as a result, causing their death.

Destruction of microorganisms using UV radiation

The UV intensity needed for the elimination of microorganisms, such as yeasts, bacteria and viruses was previously investigated and reported by UVP Inc. A table below shows an amount of germicidal, shortwave (254 nm) UV energy needed for complete destruction of certain microorganisms.

Photochemical reaction

The diagram below shows the process of formation of pyrimidine dimers using thymine as an example *(source: http://www.photobiology.info)*.



Bacteria organisms	Energy (mW/cm²/s)
Bacillus anthracis	8.7
S. enteritidis	7.6
B. Megatherium sp. (veg.)	2.5
B. Megatherium sp. (spores)	5.2
B. parathyphosus	6.1
B. subtilis	11.0
B. subtilis spores	22.0

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Other microorganisms	Energy (mW/cm²/s)
Yeast	
Saccharomyces Ellipsoideus	13.2
Saccharomyces Sp.	17.6
Saccharomyces Cerevisiae	13.2
Brewer's Yeast	6.6
Baker's Yeast	8.8
Common Yeast Cake	13.2

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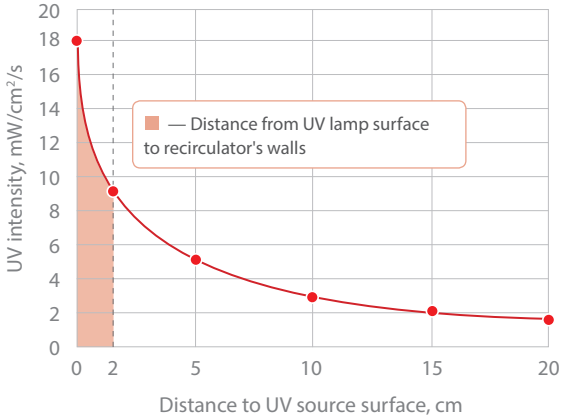
Bacteria organisms	Energy (mW/cm²/s)
Clostridium tetani	**22.0**
Corynebacterium diphtheriae	**6.5**
Eberthella typosa	**4.1**
Escherichia coli	**6.6**
Micrococcus cadidus	**12.3**
Micrococcus sphaeroides	**15.4**
Mycobacterium tuberculosis	**1.0**
Neisseria catarrhalis	**8.5**
Phytomonas tumefaciens	**8.5**
Proteus vulgaris	**6.6**
Pseudomonas aeruginosa	**10.5**
Pseudomonas fluorescens	**6.6**
S. typhimusium	**15.2**
Salmonella	**10.0**
Sarcina lutea	**26.4**
Serratia marcescens	**6.1**
Dysentery bacilli	**4.2**
Shigella paradysenteriae	**3.2**
Spirillum rubrum	**6.1**
Staphylococcus albus	**5.7**
Staphylococcus aureus	**6.6**
Streptococcus hemolyticus	**5.5**
Streptococcus lactis	**8.8**
Streptococcus viridans	**3.8**

Other microorganisms	Energy (mW/cm²/s)
Mold spores	
Penicillium Roqueforti	26.4
Penicillium Expansum	22.0
Penicillium Digitatum	88.0
Aspergillus Glaucus	88.0
Aspergillus Flavus	99.0
Aspergillus Niger	330.0
Rhisopus Nigricans	220.0
Mucor Racemosus A	35.2
Mucor Racemosus B	35.2
Oospora Lactis	11.0
Virus	
Bacteriophage *(E. Coli)*	6.6
Tobacco Mosaic	44.0
Influenza	6.6
Protozoa	
Paramecium	200.0
Nematode Eggs	92.0
Chlorella Vulgaris *(Algae)*	22.0

Table 1, *Destruction chart of bacteria and various organisms (source: UVP Inc.)*

UV Intensity measurements of Philips 25W bactericidal UV lamp

UV intensity depends on the distance from the UV source.
The graph below shows that UV intensity drops dramatically as the distance increases.



UV intensity, mW/cm²	Distance, cm
18.0	0
9.3	2
5.0	5
2.8	10
2.2	15
1.7	20

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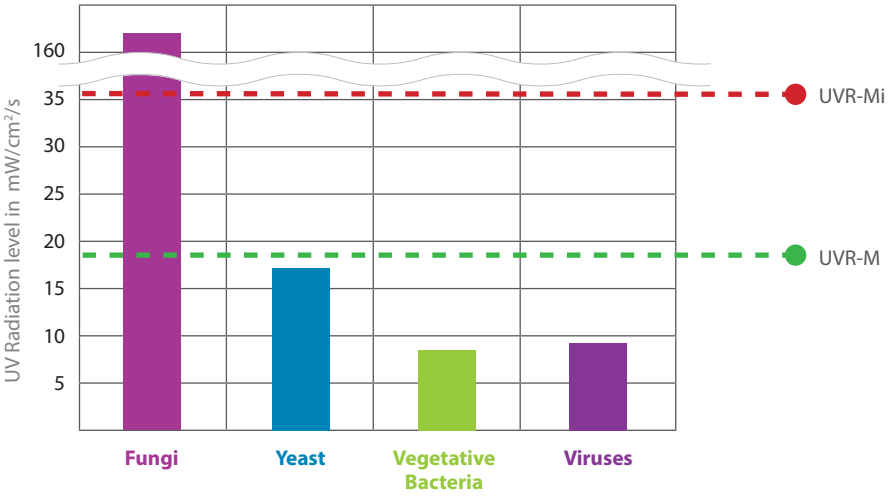
Sensitivity of microorganisms to UV radiation intensity in UV air recirculators **UVR-M** and **UVR-Mi**



Yeast	Vegetative Bacteria	Viruses
Saccharomyces cerevisiae	Clostridium tetani	Bacteriophage (E. coli)
Brewer's yeast	Mycobacterium tuberculosis	Influenza
C. albicans	Salmonella	Adenoviridae family
C. tropicalis	Dysentery bacilli	Retroviridae family
C. stellatoidea	Staphylococcus aureus	Coronaviridae family
	Streptococcus hemolyticus	

Indoor pollution level before and after recirculator operation

Creation: **September 2011**
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