VECTOTHOR AIR160

The performance of air disinfection units using UV-C Light is related to the dose of UV-C Light received by the micro-organisms, set against the time of exposure. The higher the dose of UV-C Light, or the longer the exposure period, the greater the kill.

A further factor that will determine optimal performance, and more importantly, the size of a room that can be efficiently disinfected, is the likely contaminant load present, the likely rate of future contamination of the room, and the risk posed by any presence of micro-organisms.

Performance

The VECTOTHOR AIR160 uniquely uses a Philips 60 W UV-C lamp, within a specialised aluminium-lined Disinfection Chamber, to provide optimal performance and a high dose of UV-C Light. The Table below, provides data on the effectiveness of UV-C Light in destroying various micro-organisms. The following explanation will help understand the data.

Dose

To achieve a Log 1 reduction in the numbers of a virus or bacteria, (which represents a 90% reduction in the population), requires a known dose of UV-C Light. E.g. To reduce

a *Bacillus anthracis* infestation by 90%, a UV dose of 45.2 mJ/cm^2 is required;

an influenza virus infestation by 90%, a UV dose of 36 mJ/cm^2 is required.

The UV dose as shown in the Table, in mJ/cm^2, can also be expressed as mW S/cm^2.

So, 45.2 mJ/cm^2 is the same 45.2 mW S/cm^2, which can be calculated by the formula:

Lamp power (in mW/cm^2) x the retention time of the air (in seconds)

The variable that we employ with the VECTOTHOR AIR160 is the speed of the air flow. By reducing the air flow by a factor of two (going down from 100m^3/hr to 50m^3/hr) we *increase* the retention time of the air in the UV-C Disinfection Chamber two-fold, which results in offering a significantly higher dose of UV-C to the micro-organisms as they pass through the UV-C Disinfection Chamber.

This means we achieve an increase in the reduction of our *Bacillus anthracis* or influenza virus from 90% up to 99% (a log 2 reduction) simply by controlling the air flow rate.

Time

If we extend the time factor by which we measure the performance of the VECTOTHOR AIR160, we will see noticeable improvement in the elimination of micro-organisms. The more times the air passes through the VECTOTHOR AIR160, the greater the reduction of the micro-organisms. Smaller micro-organisms also have a thinner cell wall, which is much easier to penetrate with UV-C Light; which then destroys the reproduction mechanism of these micro-organisms faster. This makes the VECOTHOR AIR160 particularly effective in eliminating viruses, which are not affected by filtration systems due to their tiny size.

We confirm the VECTOTHOR AIR160 will, in a single pass of air through the unit, which will typically occur in 2 hours for a 100 m^3 room, disinfect and purify the air up to 90%.

If we run the unit for 24 hours, it disinfects and purifies the air up to 99.99%.

UV dose to obtain 90% killing rate		
Bacteria	**Dose**	**k**
Bacillus anthracis	45.2	0.051
B. megatherium sp. (spores)	27.3	0.084
B. megatherium sp. (veg.)	13.0	0.178
B. parathyphosus	32.0	0.072
B. suptilis	71.0	0.032
B. suptilis spores	120.0	0.019
Campylobacter jejuni	11.0	0.209
Clostridium tetani	120.0	0.019
Corynebacterium diphteriae	33.7	0.069
Dysentery bacilli	22.0	0.105
Eberthella typhosa	21.4	0.108
Escherichia coli	30.0	0.077
Klebsiella terrifani	26.0	0.089
Legionella pneumophila	9.0	0.256
Micrococcus candidus	60.5	0.038
Micrococcus sphaeroides	100.0	0.023
Mycobacterium tuberculosis	60.0	0.038
Neisseria catarrhalis	44.0	0.053
Phytomonas tumefaciens	44.0	0.053
Pseudomonas aeruginosa	55.0	0.042
Pseudomonas fluorescens	35.0	0.065
Proteus vulgaris	26.4	0.086
Salmonella enteritidis	40.0	0.058
Salmonella paratyphi	32.0	0.072
Salmonella typhimurium	80.0	0.029
Sarcina lutea	197.0	0.012
Seratia marcescens	24.2	0.095
Shigella paradysenteriae	16.3	0.141
Shigella sonnei	30.0	0.077
Spirillum rubrum	44.0	0.053
Staphylococcus albus	18.4	0.126
Staphylococcus aureus	26.0	0.086
Streptococcus faecalis	44.0	0.052
Streptococcus hemoluticus	21.6	0.106
Streptococcus lactus	61.5	0.037
Streptococcus viridans	20.0	0.115
Sentertidis	40.0	0.057
Vibrio chlolerae (V.comma)	35.0	0.066
Yersinia enterocolitica	11.0	0.209

UV dose to obtain 90% killing rate		
Yeasts	**Dose**	**k**
Bakers' yeast	39	0.060
Brewers' yeast	33	0.070
Common yeast cake	60	0.038
Saccharomyces cerevisiae	60	0.038
Saccharomyces ellipsoideus	60	0.038
Saccharomyces sp.	80	0.029
Mould spores		
Aspergillus flavus	600	0.003
Aspergillus glaucus	440	0.004
Aspergillus niger	1320	0.0014
Mucor racemosus A	170	0.013
Mucor racemosus B	170	0.013
Oospora lactis	50	0.046
Penicillium digitatum	440	0.004
Penicillium expansum	130	0.018
Penicillium roqueforti	130	0.018
Rhizopus nigricans	1110	0.002
Virus		
Hepatitis A	73	0.032
Influenza virus	36	0.064
MS-2 Coliphase	186	0.012
Polio virus	58	0.040
Rotavirus	81	0.028
Protozoa		
Cryptosporidium parvum	25	0.092
Giardia lamblia	11	0.209
Algae		
Blue Green	3000	0.0008
Chlorella vulgaris	120	0.019

What about K? K is a lesser known method to calculate how much UV-C energy a micro-organism needs to receive to achieve a reduction. K is actually the inactivation constant rate given in m^2/J. Dose is accepted and known by 99% of modern scientists; K has become 'old-school thinking'.

Room Size

The smaller the room the more efficient the performance. The VECTOTHOR AIR160 was optimised to provide maximum performance and efficiency, e.g. for use in a pharmaceutical clean room, on a room size of 100 m^3. If the room size is increased, the time to achieve 99.99% elimination of the viruses present will be increased. Of course, if there is less likelihood of a high viral loading, or if there is reduced risk for heavy viral infection, the VECTOTHOR AIR160 will provide adequate performance and a significant improvement in the health and purity of the air in a larger room.

Use of the VECTOTHOR AIR160 may therefore be considered as follows:

Risk Situation	AIR160 will treat	E.g.
High Risk	Up to 100 m^3	Electrical or pharmaceutical clean room, hospital or medical facility/ surgery.
Moderate Risk	Up to 200 m^3	Doctor's waiting room, childcare centre.
Normal Risk	Up to 300 m^3	Household, office, public lounge.