

sterilAir[®]

UVC Disinfection since 1939

**For Better Hygiene
around the clock**

sterilAir[®] UVC



sterilAir[®]
UVC Disinfection since 1939

- Founded in 1939
- Based in Weinfelden, Thurgau, Switzerland
- Partners in 18 countries/areas, worldwide
- 20 employees (head office)
- R&D department with experimental laboratory
- 400 m² office space
1000 m² shop floor area
- Market segments:
 - Food industry
 - HVAC industry
 - Medical and laboratory sector
 - OEM integration
- ISO-9001 certified





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UVC applications

Air

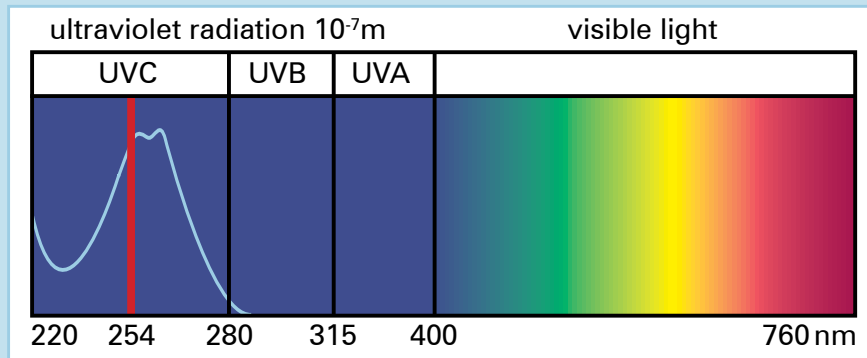
- Air conditioning and ventilations ducts
- Production and maturing rooms, working spaces
- Storage rooms and cold stores
- Food laboratories

Surfaces

- Packaging
- Cooling coils and evaporators
- Conveyor belts
- Worktops, disinfection tunnels

Water

- Spray humidifiers, cooling towers
- Water tanks, cisterns, ice water containers
- Process water
- Grey water

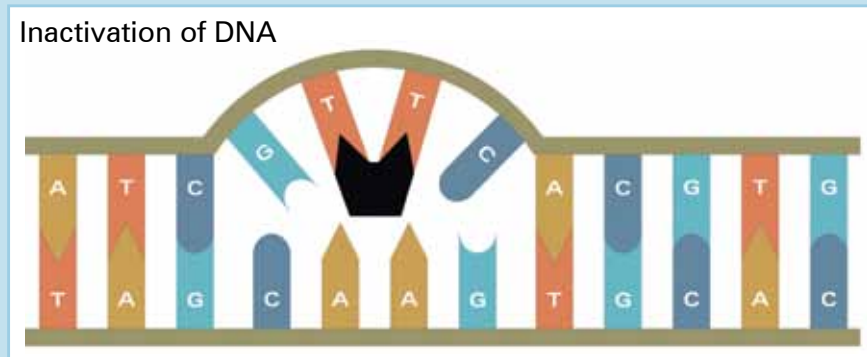
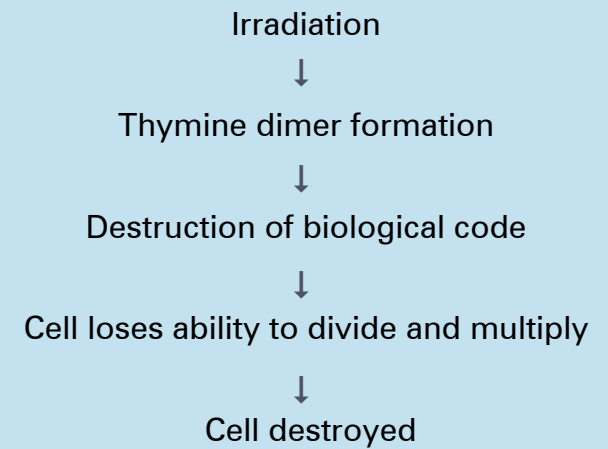


sterilAir[®] tubes produce short wave UVC_{254nm} precisely in the most sensitive range of the DNA.

UVC principle and UVC effect

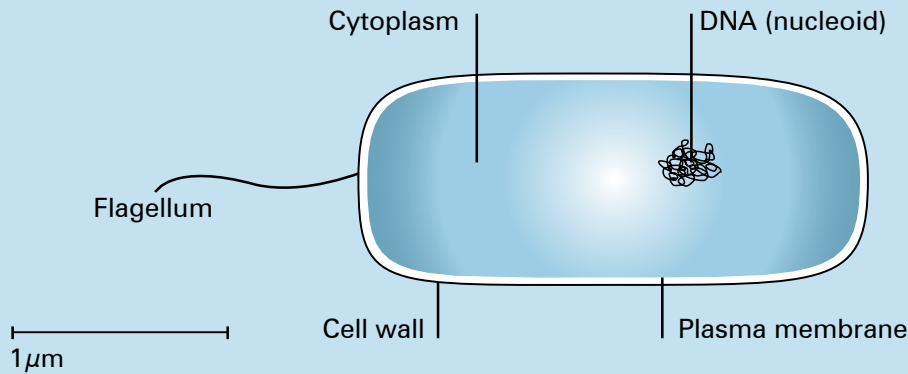
- UVC rays with strong germicidal effect at 254 nm
- Dose-response principle

Functioning:

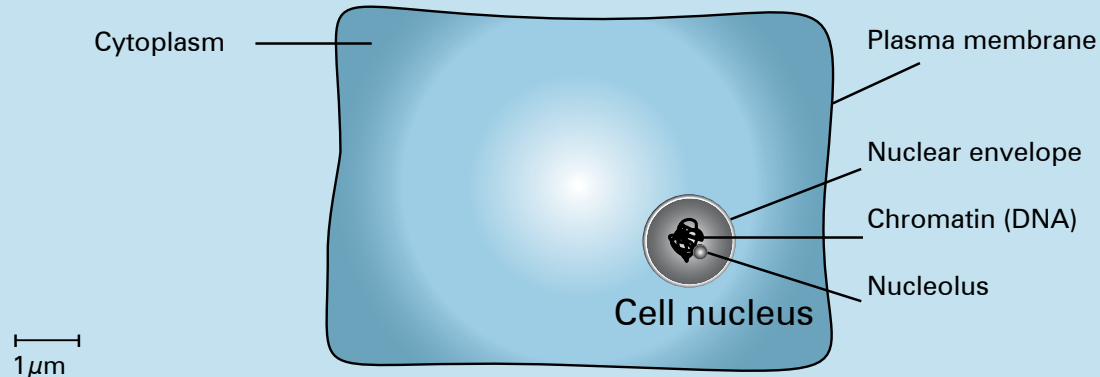


UVC_{254nm} targetedly destroys the microorganisms' DNA.

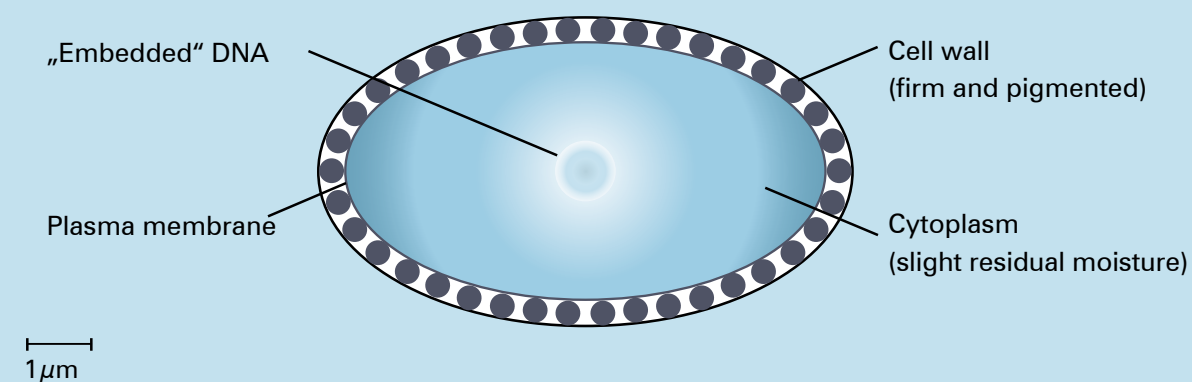
Bacteria (prokaryotic cell structure)



Yeasts, vegetative fungal cells (eukaryotic cells)



Fungal spore as survival stage



Lethal dose depending on cell structure

Virus

- Simple structure
- Basic DNA
- No DNA repair ability

Bacteria

- Non-protected DNA
- Small cellular body
- Simple plasma membrane

Yeast/vegetative fungal cells (mould)

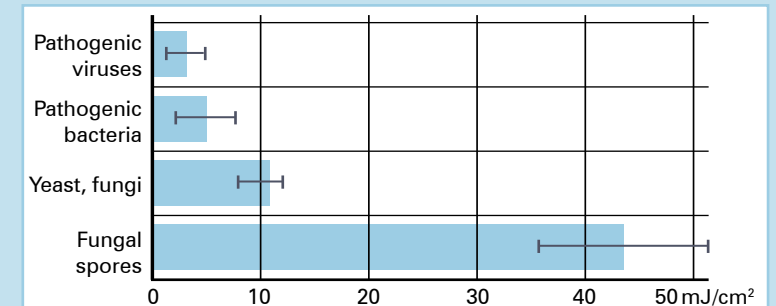
- DNA in the chromatin of the cell
- Large cellular body
- Simple plasma membrane

Fungal spores (mono or multi cellular)

- Concentrated cytoplasm
- Thick cell wall (pigmented)
- „Protected“ DNA

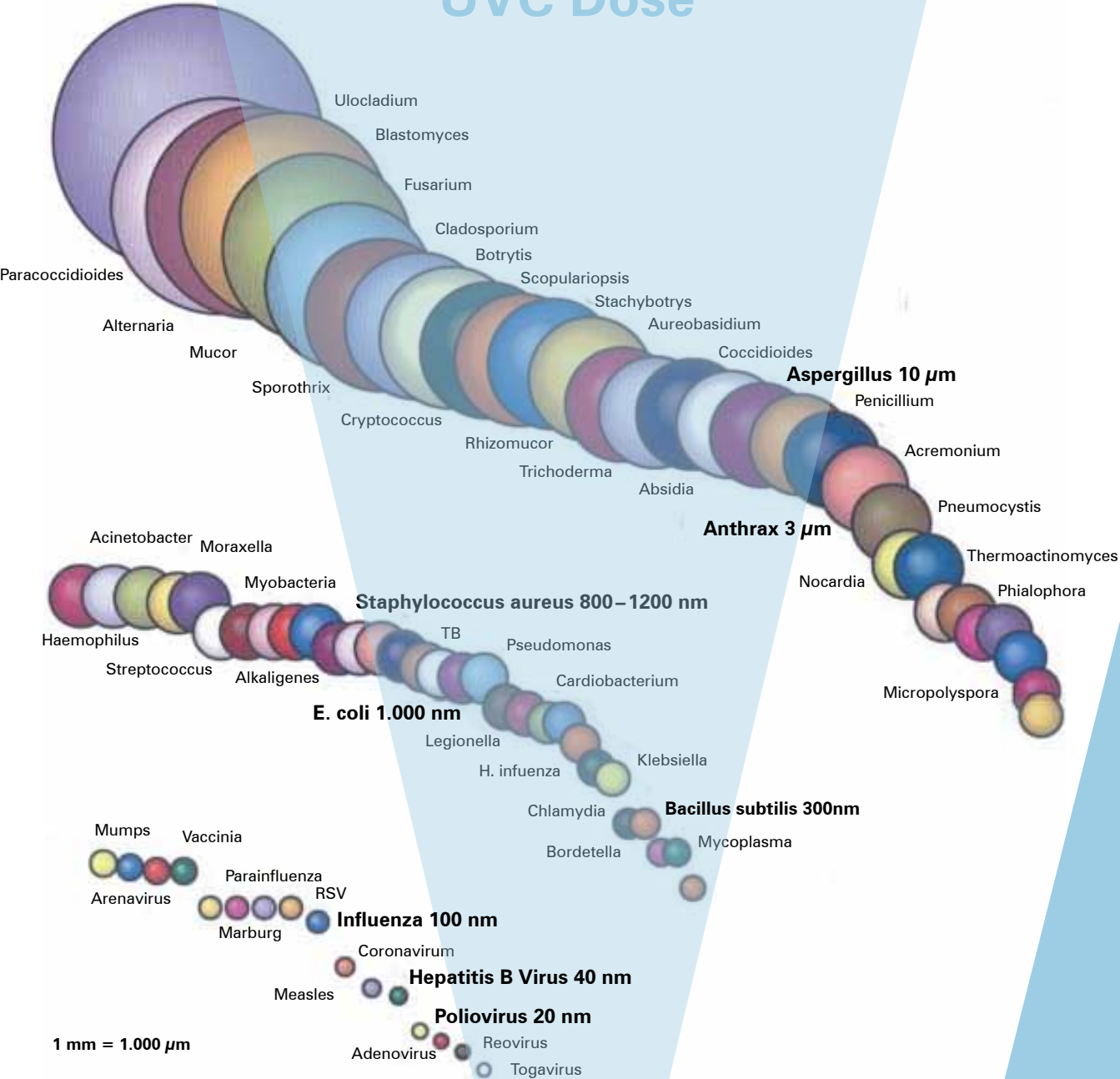
1 mm = 1.000 μm
1 μm = 1.000 nm
For comparison:
100 μm =
thickness of
human hair

Typical LD90 dosages for different groups of microorganisms



Standard deviation

UVC Dose



EU 7

EU 9

EU 10–16
filter classification

cost & energy

UVC energies required for a 90 % inactivation*

Virus

Influenza _____	2.400	Influenza H1N1 _____	2.400
Bakteriophage (E. coli) _____	3.000		

Bacteria

Streptococcus hemolyticus (Alpha Typ) _____	2.200	Serratia marcesces _____	2.500
Proteus vulgaris _____	2.700	Escherichia coli _____	3.000
Staphylococcus albus _____	3.300	Pseudomonas fluorescens _____	3.500
Staphylococcus aureus _____	4.900	Bacillus subtilis _____	6.000
Streptococcus lactis _____	6.100	Micrococcus sphaeroides _____	10.000
Bacillus subtilis Sporen _____	12.000	Sarcina lutea _____	19.800

Yeasts

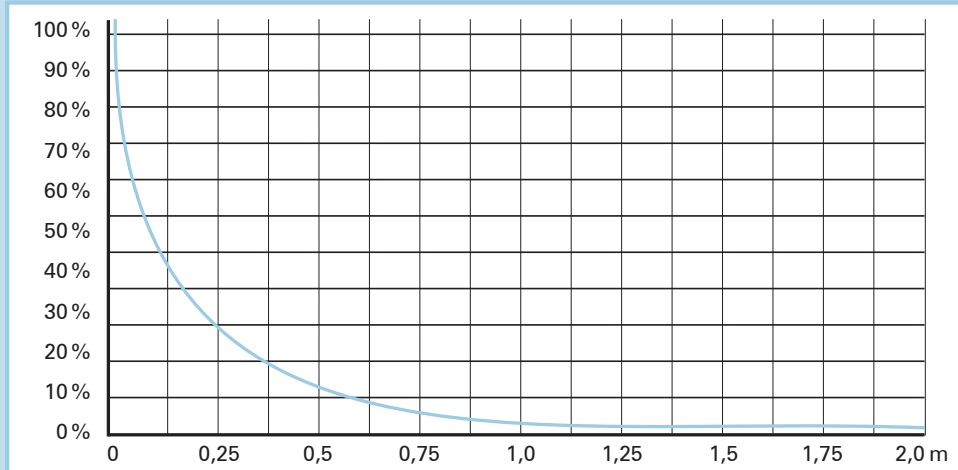
Bäckerhefe (Saccharomyces cerevisiae) _____	3.900	Saccharomyces ellipsoideus _____	6.000
Saccharomyces Sporen _____	8.000		

Moulds

Oospora lactis _____	5.000	Penicillium roqueforti _____	13.000
Mucor racemosus _____	17.000	Penicillium expansum _____	22.000
Penicillium digitatum _____	44.000	Aspergillus glaucus _____	44.000
Aspergillus flavus _____	60.000	Rhizopus nigricans _____	95.000
Aspergillus niger _____	100.000		

*Data in $\mu W \cdot sec. / cm^2$ ($\mu J / cm^2$)

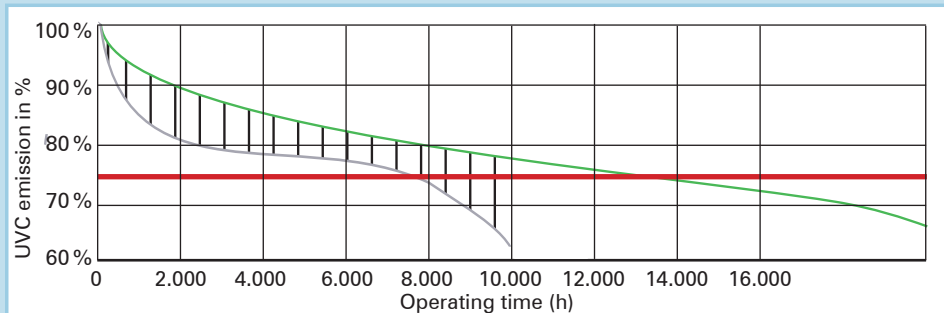
UVC emission in relation to distance of UV source



UVC tubes

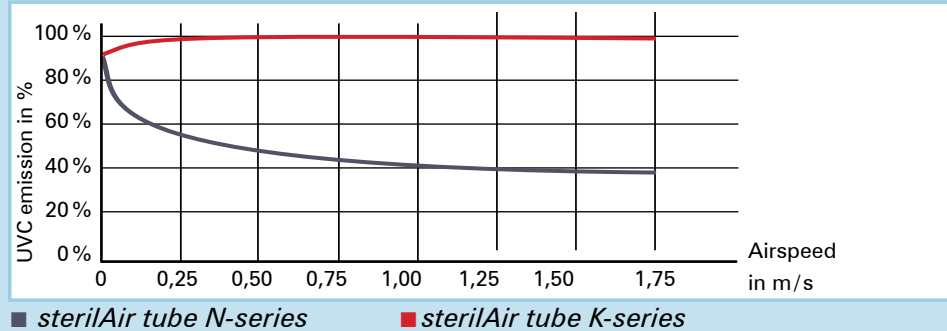
- > 90% of the radiation in the bactericidal range
- Utilisation: 12'000 hours (remaining capacity 75%)
- Linear wear
- Energy saving ballasts
- On request, with shatter protection compliant to HACCP and IFS standards

UVC emission and life span

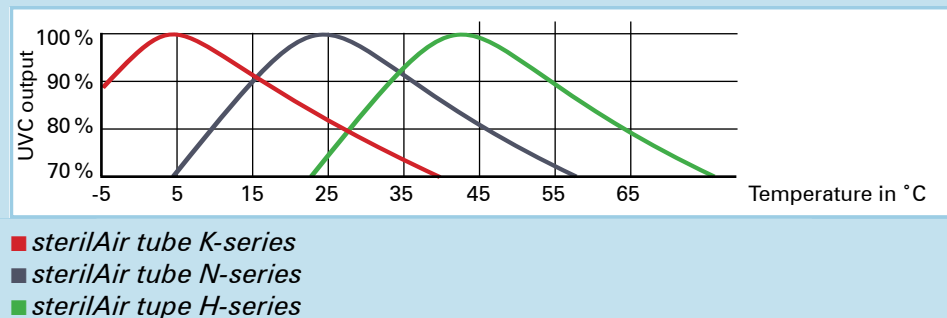


- *sterilAir UVC tube*
- *conventional UVC tube*

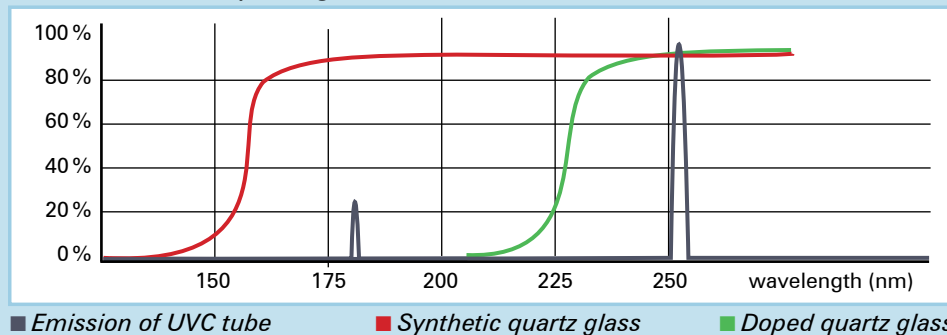
UVC emission at 15°C



Thermal characteristics of different tubes



Transmittance of quartz glass



Optimised UVC tubes for ideal emissions

- Different types of tubes for varying applications
- Constant output even under adverse conditions
- Precondition for reliability and stability of an installation
- Ozone free (ozone forming on request, using synthetic quartz glass, 185nm penetrable)





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UVC in HVAC systems

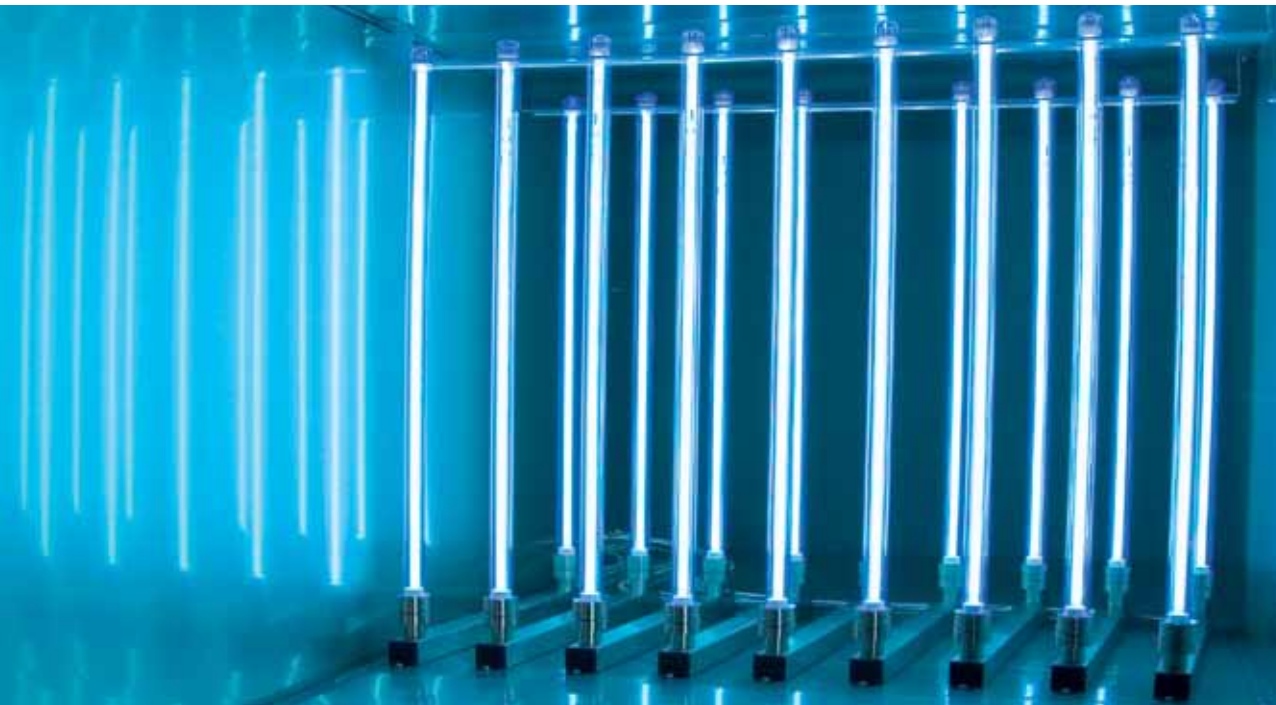
Centralised elimination
of air hygiene problems

- Air ducts
- Air conditioning plants
- Supply air systems
- Heat exchangers
- Air humidifiers
- Laminar flow systems
- Clean room technology

Products lines:

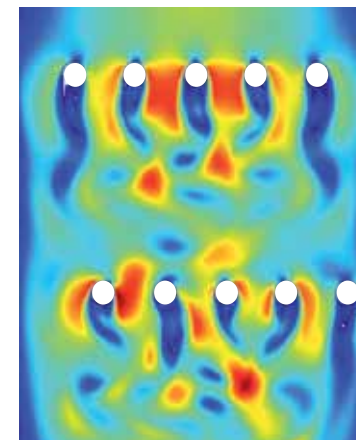
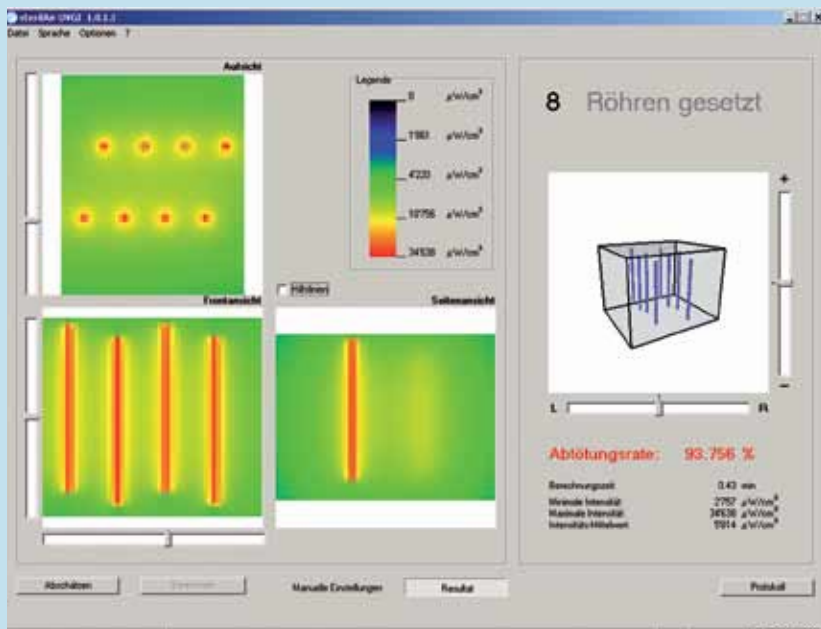
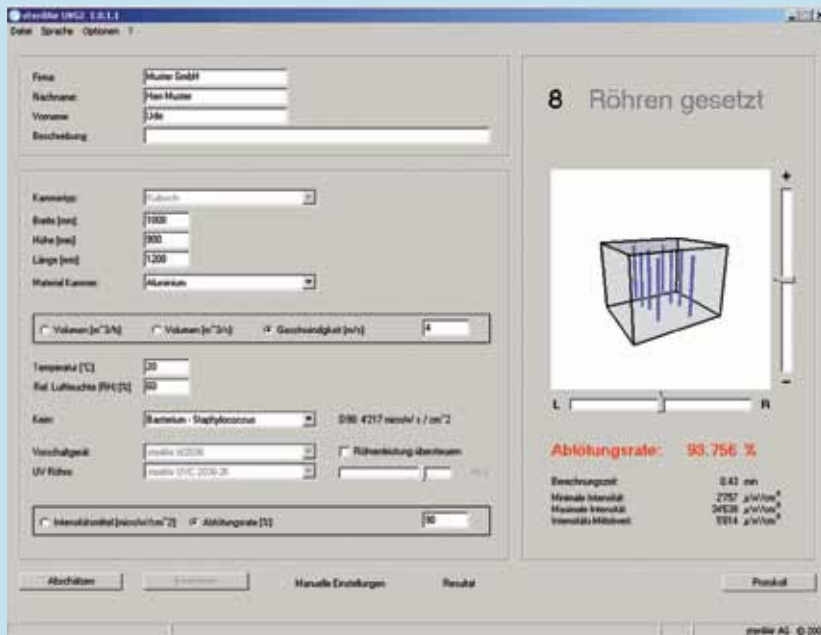
Air stream modules (ES range)

Flange modules (EF range)



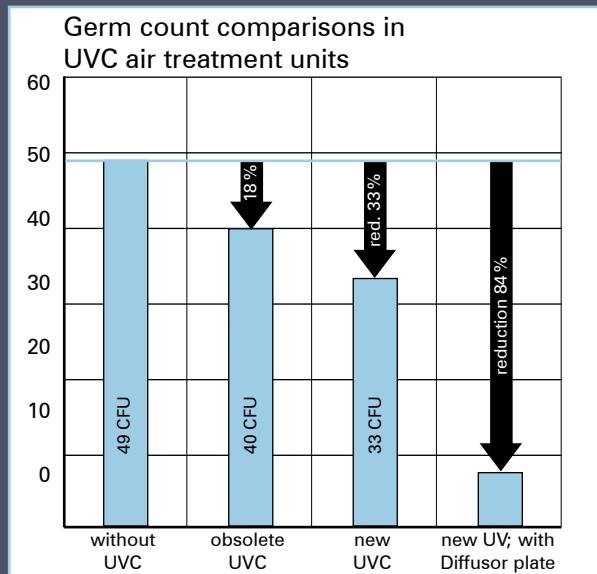
Simulation and calculation

- Computer aided 3D calculation
- Air flow simulation
- Reliable and accurate planning process
- False-colour rendering
- UVC disinfection estimates based on scientific methods
- Developed in collaboration with the Swiss Federal Institute of Technology (ETH), Zurich



Air flow simulation with optimal positioning of the UVC tubes

Optimal adjustment to prevailing conditions

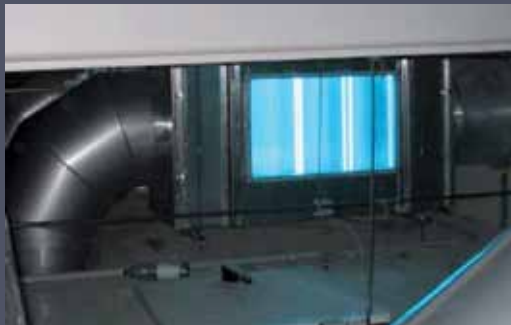


	Sate of AHU	UVC intensity mW/cm ²	CFU* air germ sampler	degree of disinfection
Control group	without UV	—	49	0 percent
Initial situation	obsolete UVC tubes; without diffuser	17	40	18 percent
Initial situation with new UVC tubes	new UVC tubes; without diffusor	43	33	33 percent
After modification	new UVC tubes; with diffusor	151	8	84 percent

* colony forming units

Highly effective air disinfection due to homogeneous air distribution with equal flow rate!

AHU



Initial situation (7 m/sec. and 2°C)



Modification with diffuser (2,2 m/sec. 2°C)





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UVC room air disinfection

Decentralised active air treatment

- Very high disinfection rates
- For round the clock operation
- Low maintenance, easy to operate



For different applications:

- Storage rooms
- Production areas
- Maturing rooms
- Cold stores

Products lines:

Air recirculation units (UVR range)

UVC room air disinfection

Decentralised solutions for
complex contamination problems

- Overhead installation
- Without interrupting work processes
- Maximum cost-benefit factor



Different systems for numerous applications:

- Integrated monitoring of operating hours
- Units adapted for ambient temperatures ranging from -20°C to +40°C

Products lines:

Emitters with protective screen (WR range)

Open wall emitters (WB range)

Open ceiling emitters (D range)

Sluice with protective screen (SWR range)

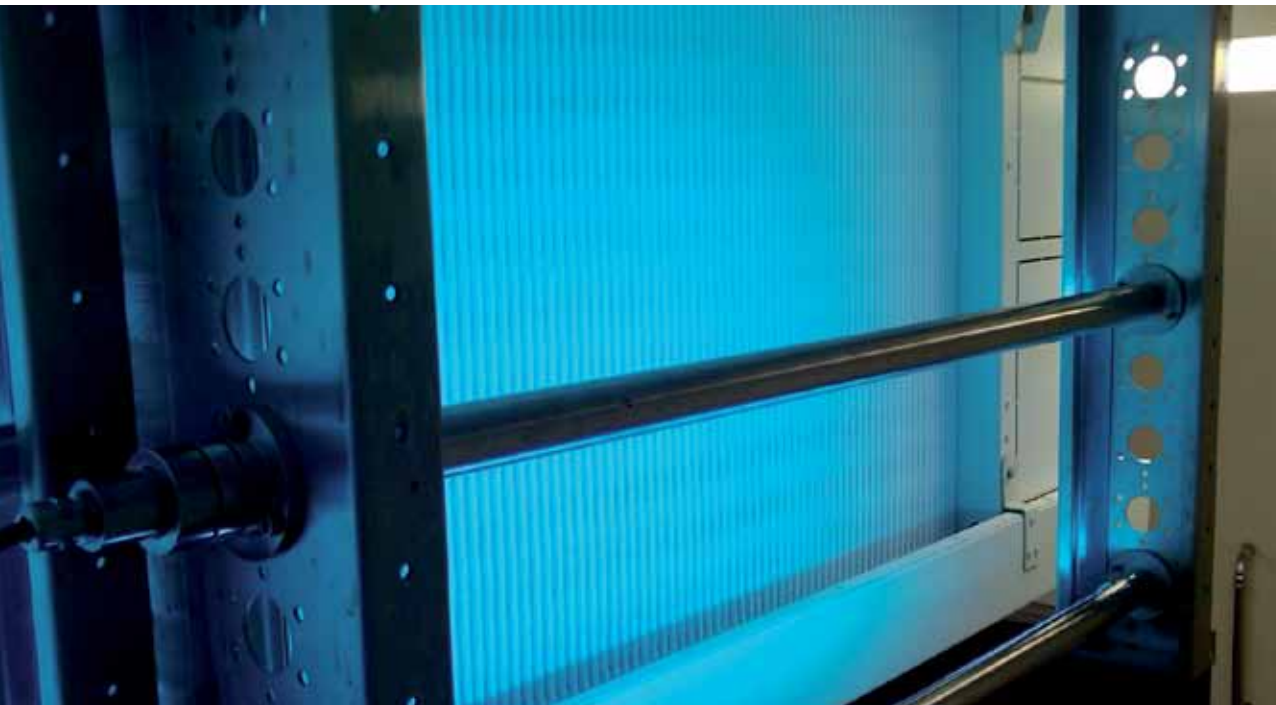


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UVC fan coil disinfectors

Straightforward investment for significant improvement in hygiene

- Germ free condensation zone (drip pan)
- Also available as installation kit for cooling units
- Significant reduction of facility maintenance cost
- Constant high hygienic level of air quality



Different models:

- Modular concept
- Easy to install
- For round the clock operation

Products lines:

Fan coil adapter (LKV range)

Flange modules (EF range)

Surface Hygiene

UVC modules for conveyor belt
and surface disinfection

- Deboning and conveyor belts
- Slicers
- Box conveyors
- Packing lines
- Filling lines

For packing machines:

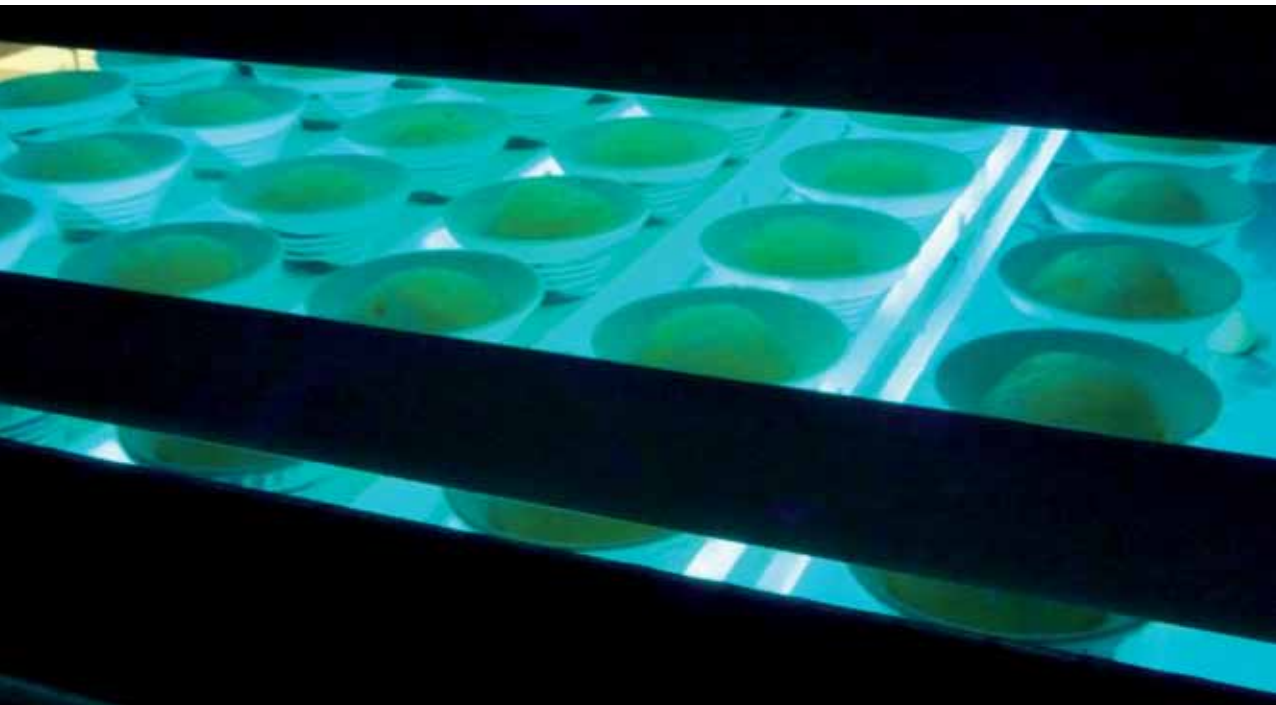
- Thermoforming films
- Plastic trays
- Bottles, beakers
- Screw caps

Products lines:

Surface emitters (T2000 and DR2000 range)

Deboning and conveyor belt disinfectors (T2011 range)

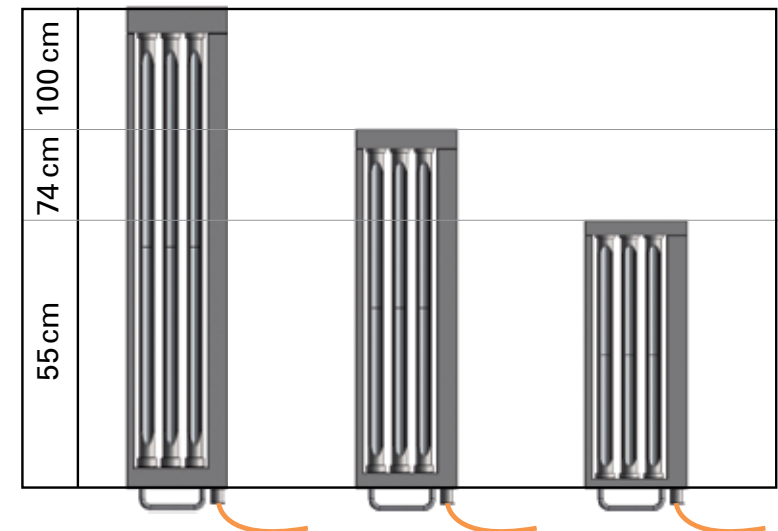
Modular units (T2004)



UVC belt disinfection

Continuous germ reduction on conveyor belts and surfaces

- Deboning and conveyor belts
- For adverse conditions (IP65)
- Field proven

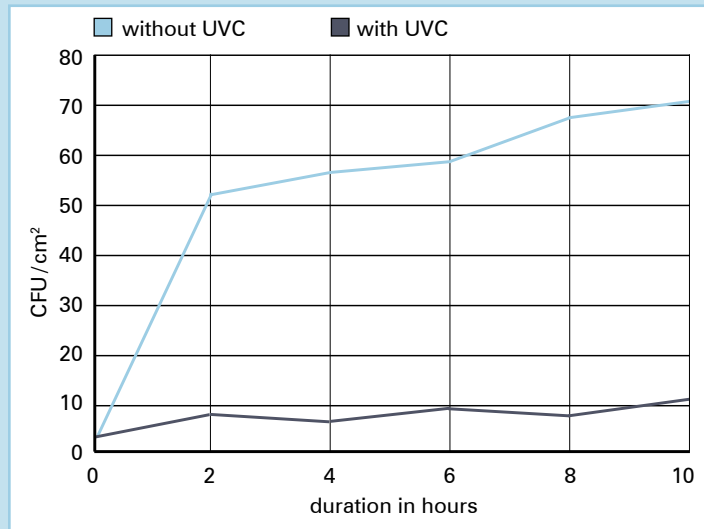


Products lines:

Deboning and conveyor belt disinfectors
(T2011 range)

**Typical daily pattern on a conveyor belt:
Enterobacteriaceae**

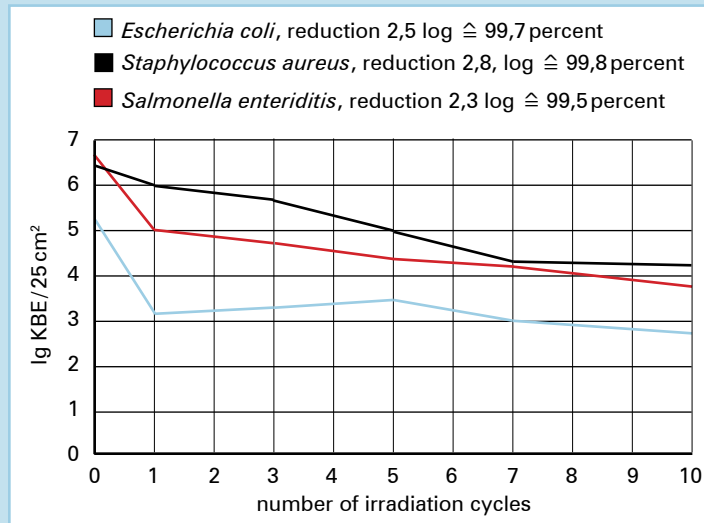
Comparison of germ formation without UVC treatment and with belt disinfection



**UVC belt disinfection:
Comparative tests**

- Constant low germ counts
- Uninterrupted working processes
- Extended shelf life (ESL) of the products
- Preventing cross-contamination

Effects of germ reduction due to UVC treatment



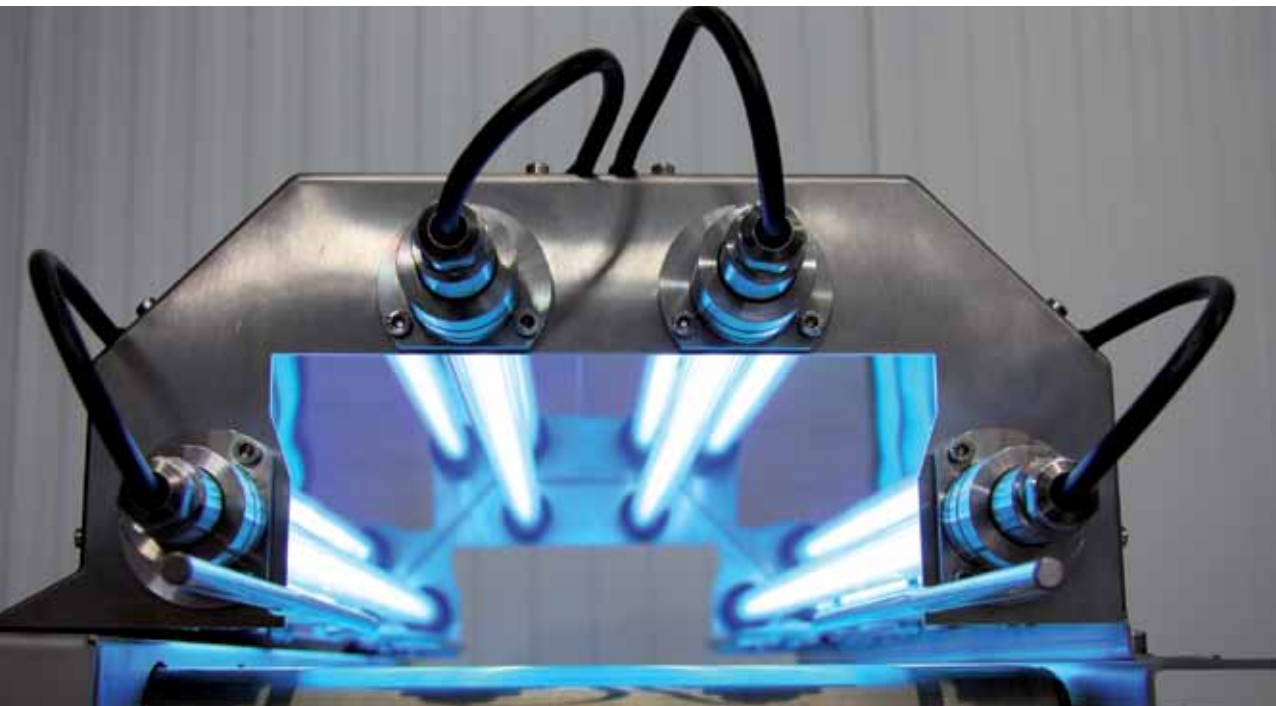
Source: Leibniz University of Hanover, 2008
artificially contaminated conveyor belt



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Integrated UVC solutions

- Variable lengths and shapes of the UVC tubes
- Ballasts of different power ratings
- High efficiency reflectors
- Monitoring and control systems
- Emitter components, etc.



Our strong points:

- Customised concepts
- Can be retrofitted in existing installations
- Flexibility and know how in planning of optimal disinfection solutions

Products lines:

Flange modules (EF range)

Installation modules (ET range)

Surface modules (ER range)

UVC water disinfection

Ideal fields of applications for
hygienic problems in fluids

- Stagnant water
- Circulating water
- Flow-trough water
- Process water

Important parameters:

- Water transmission
- Temperature
- Additives
- Total volume or volume flow
- Shape of the basin / reservoir

Products lines:

Immersion units (AQT and TGL range)

Flange modules (EF range)

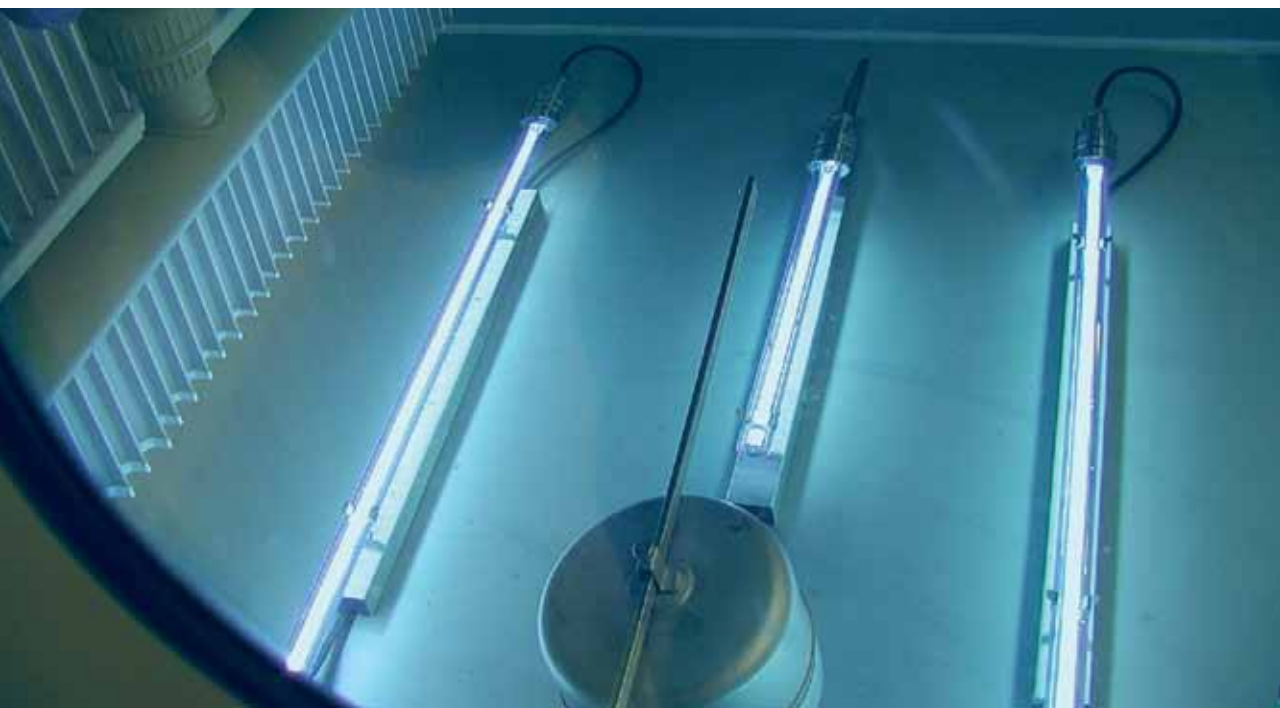




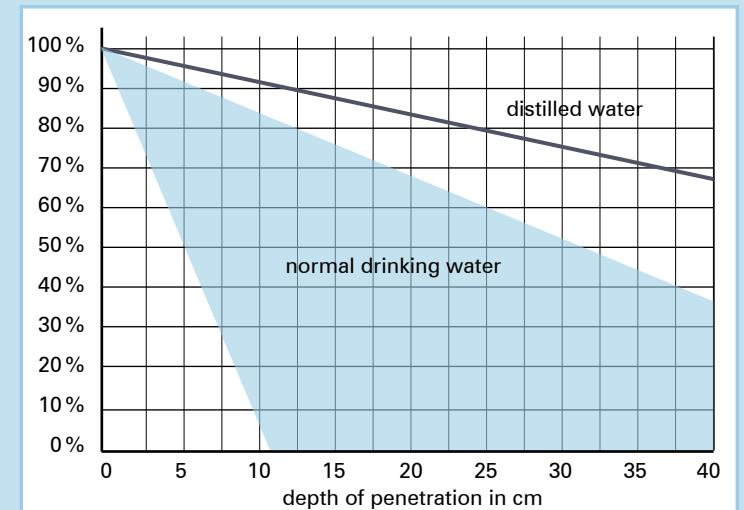
UVC water disinfection

Immersion units for different fields of application

- Cooling towers, air washers, water tanks
- Cooling baths, brine waters (sausage and cheese manufacturing)
- Fish breeding and decorative ponds (e.g. koi ponds)
- Grey water cisterns



Absorption in water: reduction of UVC radiation



UVC water disinfection in flow-trough systems

Optimised photoreactors for
all kind of applications

- Competitive PVC reactors for industrial use
- High-class stainless steel reactors for drinking water



All sterilAir UVC advantages at a glance

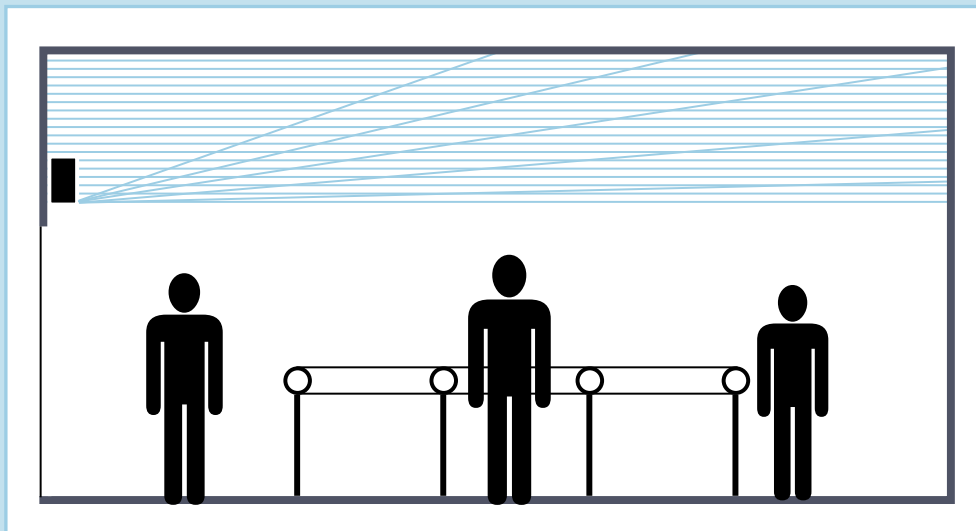
- Chemical free, no ozone and free of residues
- Low running and maintenance costs
- Easy to install, flexible use
- High service life of the UVC tubes
- Highly effective against bacteria, yeast, virus and mould
- Without interrupting work processes
- Retrofittable to existing concepts
- Low maintenance
- Conforms to VDI6022
- On request, with shatter protection (compliant to HACCP and IFS standards)



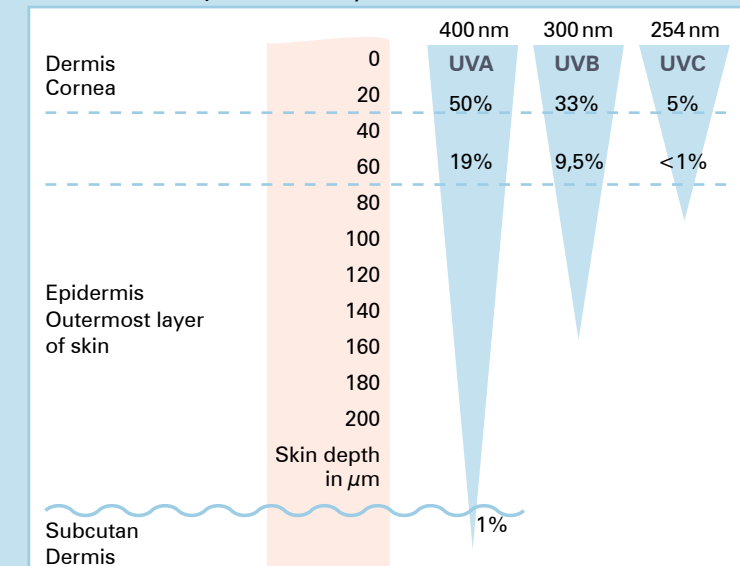
Benefit from the UVC potentials – avoid the risks

- UVC radiation only has a superficial effect
- Avoid direct exposure to radiation
- Protection provided by ordinary glass, clothing, safety goggles
- Risks resulting from improper use: sunburn and conjunctivitis

Upper-room method



Penetration depth of UV rays in the human skin



Plastic materials testing with UVC

Simulation \approx 15 to 20 years

- Length of belt
- Speed of belt
- Material of the belt modules
- Daily operating hours

Test procedure:

20 days of exposure

80'000 mWs/cm²

\approx 20m conveyor belt length and 250 days per year

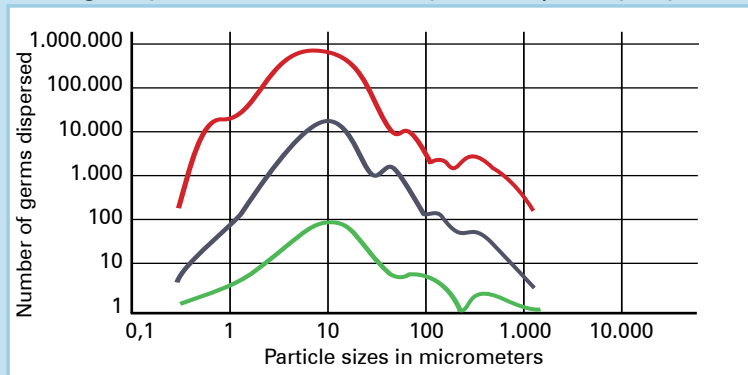
> 15 years



Characteristics of important bacteria

Type of bacteria	Occurrence	Transmission	Survival time outside human body
A-Streptokokken	nose and throat	droplet contact	hours up to a few days
Legionella pneumophila	water	inhaling contaminated aerosols	weeks up to a few months
Mycobacterium tuberculosis	lungs	droplet contact	days up to a few months
Pseudomonas aeruginosa	aqueous surroundings	contact with skin and mucosa	weeks up to months
Staphylococcus aureus	skin nose and throat	contact with skin and mucosa	weeks up to months

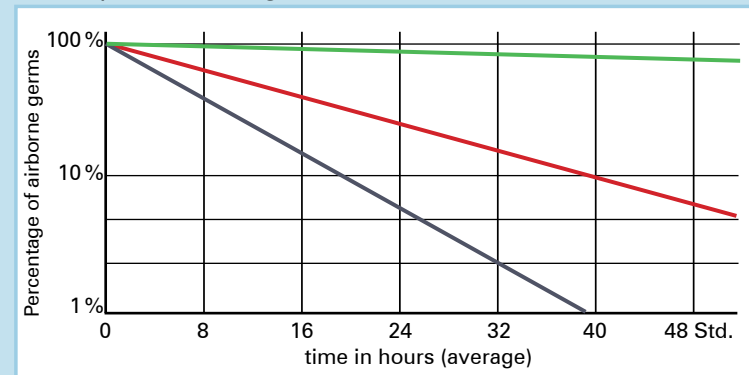
„Biological pollution of the atmosphere“ by sick people



— Sneezing
— Coughing
— Speaking

Source: HPAC-Engineering, 1998:38

Viability of airborne germs in a closed room



— Moulds
— Virus
— Bacteria

Source: HPAC Engineering, 1998:38