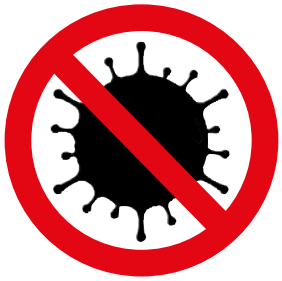

ENGINEERS OF LIGHT

CONFIRMATION OF EFFECTIVENESS

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UV-C (short-wave ultraviolet radiation) has been used for decades in water treatment and in hospitals against various pathogenic germs. When used against microorganisms, viruses and germs, UV-C radiation has proven to be a suitable agent.
According to the current state of science, there are several transmission routes of the SARS-CoV-2 virus. Once as smear infection on surfaces. A countermeasure is the disinfection of surfaces with disinfectant or by direct irradiation with UV-C sources and, of course, hand washing. In the case of airborne infection, a distinction is made between droplet and aerosol infection. Measures against droplet infection are mouth-nose protection and a distance of 1.5 meters. Measures against infection by aerosols containing viruses are FFP2 masks, sufficient ventilation, air sterilization and inactivation by direct UV-C radiation or mobile air sterilizers such as ZAPP!18 and ZAPP!80 with internal UV-C sources.

UV RADIATION

UV radiation is optical radiation in the wave range from 100 nm to 400 nm. The range of ultraviolet radiation is divided into UV-A radiation (315 to 400 nm), UV-B radiation (280 to 315 nm) and UV-C radiation (100 to 280 nm). UV radiation is not visually perceptible to the human eye. UV-C radiation is already absorbed in the atmosphere, which is why living organisms, microorganisms and viruses cannot develop natural resistances. UV-C radiation is absorbed directly by DNA/RNA, destroying its structure and preventing reproduction and thus the infectivity of microorganisms. The absorption maximum of DNA/RNA is at a wavelength of 265 nm.
Depending on the species, a certain dose is required to inactivate a virus or kill a microorganism. This is calculated from the irradiance and the required irradiation time.

DANGERS OF UV-C RADIATION FOR HUMANS

Improperly applied, UV-C radiation can have a damaging effect on humans, other living creatures and materials. Exposure to UV-C radiation can cause conjunctivitis, corneal inflammation or increase the risk of skin cancer. Professional design, labeling and documentation of the devices and their installation and operation enable high effectiveness and safe use. When purchasing a UV-C air purifier, the Federal Office for Radiation Protection recommends paying

particular attention to ensuring that the manufacturer's specifications for a device are as complete and specific as possible. To ensure that the users of the devices are not endangered by the emitted radiation or to avert a photobiological hazard, the distance to the device and the recommended positioning in the room are particularly relevant. All technical information and recommendations for the use, positioning and installation of ZAPP!18 and ZAPP!80 are documented in the user manual, the product brochure or on www.waldmann.com.

UV-C air disinfection

UV-C air disinfection is a multidisciplinary issue from virological requirements to radiation technology. Depending on the germ and the quality of germ removal, different effective irradiation doses are required.
Sterilization is achieved with a germ reduction of 99.9999% (Log6). Disinfection is said to occur at a germ reduction of 99.999% (Log5). Cleaning usually has a germ reduction of 90% to 99.9% (Log1-3).

Mobile UV-C air sterilizers ZAPP!18 and ZAPP!80

Mobile or decentralized air disinfection devices offer additional protection against infection by aerosol-induced infections as accompanying measures to the recommended ventilation. Mobile stand-alone or stationary wall- and ceiling-mounted devices can be used. In this case, aerosols are passed through a device such as ZAPP! by active fans. Inside the device, the aerosols are disinfected with UV-C radiation and then returned to the room. The most important data besides the circulated air volume per hour are the average irradiation dose and inactivation rate at single passage, the electrical power consumption, type of radiation source and noise level.

Effectiveness

The radiation dose is decisive for the effectiveness of disinfection. Depending on the application requirements, this can be determined from the device dimensions, flow conditions and target organisms. The disinfection efficiency depends on the air flow rate and the exposure time. At low air flow rates, the exposure time is longer, thus also the inactivation of infectious aerosols, but this results in a lower air exchange rate. According to calculation and punctual re-measurement, up to 99% inactivation can be assumed for ZAPP80! and 90 to 95% inactivation for ZAPP!18.

Ozone formation

Both ZAPP!18 and ZAPP!80 use ozone-free emitters. Both devices do not cause increased levels of ozone compared to the variation of natural room air concentration.

Ionization

The ZAPP! devices do not cause increased values of positive or negative ions in comparison with the variation in natural indoor air concentration.
Since the spread of the Coronavirus, hygiene concepts have become paramount, even in everyday working life. Wearing a mask, keeping a distance, and ventilation are now familiar measures. The workplace guideline ASR A3.6, for example, recommends a time interval of one hour for the ventilation of office rooms, for example, and 20 minutes for meeting and seminar rooms. The use of UV-C air purifiers can result in an extension of the ventilation interval and provide a further means of effectively combating the SARS-CoV-2 pathogen. Quantification of the extension of the ventilation interval is currently difficult because valid scientific studies are not yet available.
UV-C radiation has proven to be a suitable means of combating viruses and germs. UV-C air sterilizers such as the ZAPP!18 and ZAPP!80 devices make an additional contribution to pandemic containment by inactivating infectious aerosols.
With regard to labeling, documentation of the devices, technical data as well as information on design, planning, installation and operation, please refer to the manufacturer Waldmann.