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## Know How: Ultraviolet light (UVC) to fight COVID-19

### **What is COVID-19?**

A new virus called the severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) was identified as the cause of a disease outbreak that began in China in 2019. This disease is called corona virus disease 2019 (COVID-19).

WHO named the novel viral pneumonia as “Corona Virus Disease (COVID19)”, while the International Committee on Taxonomy of Viruses (ICTV) suggested this novel corona virus name as “SARS-CoV-2” due to the phylogenetic and taxonomic analysis of this novel corona virus.

In March 2020, the World Health Organization (WHO) declared COVID-19 a pandemic. Public health groups, including the U.S. Centers for Disease Control and Prevention (CDC) and WHO, are monitoring the pandemic and posting updates on their websites. These groups have also issued recommendations for preventing and treating the illness.

### **How does COVID-19 spread?**

Data has shown that it spreads from person to person among those in close contact (within about 6 feet, or 2 meters). The virus spreads by respiratory droplets released when someone infected with the virus coughs, sneezes or talks. In addition, the incubation period for individuals infected with SARS CoV-2 has been reported to be ~1–14 days.

### **How do we disinfect our clinics and hospitals?**

Highly infectious microbial and viral diseases are a major challenge to global health, and, as such, are also a significant risk to global financial stability and security. While vaccines play a key role in preventing viral epidemics and pandemics, once an outbreak has occurred, the implementation of disinfection measures to limit spread becomes paramount.

By using UV-C Lamp technology we can disinfect and sanitize different area such as Hospital, Hotel, restaurant, Public places etc.

Use Ultraviolet germicidal irradiation (UVGI) for 2 min to 6 hours to disinfection and its depending upon wattage of the light source, room size and UV light position in the room.

## How does UVC destroy germs?

The high energy from short wavelength UVC light is absorbed in the cellular RNA and DNA, damaging nucleic acids and preventing microorganisms from infecting and reproducing.

*UVC is strongly absorbed by RNA and DNA bases leading to molecular structural damage via a photodimerization process.* This results in virus inactivation, such that they are no longer able to replicate.

The amount of inactivation is directly proportional to the UVC dose, which is received, and this, in turn, is the result of its intensity and duration of exposure. The farther away you keep an object from the light source, the less UVC will reach the target, so only a quarter of the UVC remains when the distance doubles.

The UV light emitted by a source is expressed in watts (W) and the irradiation density is expressed in watts per square meter (W/m<sup>2</sup>). For germicidal action dose is important. The dose is the irradiation density multiplied by the time (t) in seconds and expressed in joules per square meter (J/m<sup>2</sup>). (1 joule is 1W.second).

## Calculation irradiation time

Example against SARS CoV-2 : SARS CoV-2 is quite similar to COVID-19 . UVC Irradiation time needed for SARS CoV-2 is 241 J/m<sup>2</sup> (At present Irradiation time to disinfect COVID-19 not confirm so we considering SARS CoV-2 is quite similar to COVID-19).

Desired direct exposure time in seconds is:

$$\text{Exposure\_time} = \text{Desired\_UV\_dose} \times 4 \times \pi \times (\text{UV\_bulb\_distance})^2 / \text{UV\_bulb\_power}$$

Suppose,

$$\text{UV\_bulb\_power} = 60 \text{ Watts}$$

$$\text{UV\_bulb\_distance} = 3 \text{ M}$$

$$\text{Hance, Exposure time} = 241 \text{ J/m}^2 \times 4 \times 3.14 \times 9 / 60 \text{ seconds}$$

$$= 3026.96 \times 9 / 60 \text{ seconds}$$

$$= 3026.96 \times 0.15 \text{ seconds}$$

$$= 454 \text{ second or } 7.5 \text{ Minute}$$

### **How close to the surface do the lamps need to be?**

The exposure of germicidal ultraviolet is the product of time and intensity. High intensities for a short period and low intensities for a long period are fundamentally equal in lethal action on bacteria. The inverse square law applies to germicidal ultraviolet as it does to light: the killing power decreases as the distance from the lamps increases. **The average bacterium will be killed in ten seconds at a distance of six inches** from the lamp in an Ultraviolet Germicidal Fixture.

### **How do you determine the square footage that one germicidal UVC lamp will cover?**

This is determined by the wattage of the lamp. Example: Ideally A 15-watt lamp will cover approximately 100 square feet; a 30-watt lamp will cover approximately 200 square feet. But practically its depends on occupancy and items present in room. So we suggested to double the wattage i.e. 30-watt lamp for 100 square feet room and 60 Watt Lamp for 200 square feet room.

#### **UVC fixtures.**

ultraviolet have been safely used in homes, as well as in hospitals, laboratories, clean rooms, doctors' offices, commercial buildings, food processing plants and other **commercial** and **residential** environments throughout the world - any place a concern for clean air exists.

#### **Germicidal lamps kill viruses.**

Germicidal UVC lamps kill up to 99.9% of most viruses, airborne bacteria and mold spores.

#### **Germicidal UV take care of mold Also.**

Germicidal UVC lamps will kill up to 99.9% of mold and help prevent future mold growth.

#### **UVC lamps used to disinfect air in a room.**

Germicidal UVC lamps can be used in ceiling fixtures suspended above the people in a room, or within air ducts of re-circulating systems. The first method is called Upper Air Irradiation. The fixtures are shielded on the bottom so that the radiation is directed only up toward the ceiling and out the sides. These **upper-air germicidal fixtures** are mounted at least 7ft. above the floor so that people will not bump into them or look directly at the lamps.

The second method of air disinfection uses UVC lamps placed inside the ventilation system ducts. If a ceiling is too low for an **upper-air irradiation fixture**, this type of an in-duct germicidal fixture can be



used. Also, because people are not exposed to the UVC radiation, very high levels can be used inside the ducts.

## **UVC lamps should be cleaned**

UVC lamps should be checked periodically (approximately every three months), and can be cleaned with a dry cotton cloth or paper towel. Wear rubber gloves and clean with alcohol only. This will also help maximize lamp life.

## **Effect of UVC on Human.**

Prolonged, direct exposure to UVC light can cause temporary skin redness and eye irritation, so do not allow exposure to ultraviolet irradiation and allow for safe operation and maintenance.

## **Effects of UVC light on surrounding materials.**

Long-term exposure of germicidal UVC light to plastics will shorten the shelf life of the plastic by approximately 10%. Example: If the plastic would normally last about ten years, and it's exposed to germicidal UVC light the entire time, it would probably need to be replaced in 9 years. Plant life may be damaged by direct, or reflected, germicidal ultraviolet rays. Transient dyes and colors may be faded from prolonged exposure to ultraviolet rays.

## **Safety precautions should be taken when using germicidal UVC.**

In personal protection applications (the use of lamps for room irradiation in homes, schools, offices, etc fixtures are mounted above eye level. Only the upper air is irradiated and persons or animals occupying the area receive no direct exposure. Personnel should be protected by wearing either goggles or face shields, and by covering as much skin as possible with clothing or sun block.

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