Ultraviolet Germicidal Irradiation (UVGI) with Infrared Sensing

Model: FY – 30FSI

FY – 30FS1 has high capacity performance and delivers 120W of powerful broad spectrum sterilization with as little as 3 minutes. Equip with infrared sensing which is more secure to use. Help to sterilize sensitive areas such as hospital, clean room, server room, hotels, offices and etc.

Key Benefits:

- Four tubes structure with a total of 120W sterilization power (≥30W x 4 for each tube)
- Standing design gives a wide coverage up to 60m² (static area)
- Movable and foldable, able to adjust into various angles: 30°, 60°, 90°, 135°, 180°
- Equip with infrared sensing (auto cutoff if someone accidentally enter the room; auto turn on after the room is vacant)
- Equipment with timer (0 – 1440 minutes)
- Equip with time lag function
- No known resistance against UVGI
- Neutralize bacteria, viruses, mold and other pathogens
- Do not create moisture environment
- Zero chemical residue and stain

Performance		Dimension	
Number of tubes	: 4	Net Weight	: 21Kg
Power	: ≥30W each tube	Dimension (mm)	: 1190 X 400 X 340 (Off Mode)
Coverage area	: 60m² (static area)		2020 X 1110 X 340 (On Mode)
Voltage	: 220V ± 10%	Material	: Stainless Steel
Frequency	: 50Hz ± 10%		
Input power	: 180VA		
UV Wavelength	: 253.7nm		
Radiant Intensity	: ≥107uw/cm² (each tube)		

Comparison Table

Comparison of Environmental Disinfection Benefits	High – Energy Pulse Xeon UVC Sterilizer	Ozone Shock Treatment	Ordinary UVC Lamp	Physical Chemical Cleaning	Misting
Environment Disinfection Rate	Average	High	Average	Very High	Average
Sterilization Time 100sqm	1 – 5 minutes	60 – 120 minutes	45 – 120 minutes	300 – 840 minutes	30 - 60 minutes
Sterilized Area at Stagnant Position	≥ $100m^2$	≥ $100m^2$	$30m^2$	Nil	Nil
Cost of Use	Low	Low	Low	High	Average
Chemical Residue	None	None	None	Yes	Yes
Presence of People During Disinfection	No	No	No	Yes	Depends on Chemical
Coverage	High	Very High	High	Low	High
Not suitable for Environment Type	Light Sensitive Areas	Human Presence	Light Sensitive Areas	Nil	Moisture Sensitive areas

References

There is also a third type: UVC. This relatively obscure part of the spectrum consists of a shorter, more energetic wavelength of light. It is particularly good at destroying genetic material – whether in humans or viral particles. Luckily, most of us are unlikely to have ever encountered any. That's because it's filtered out by ozone in the atmosphere long before it reaches our fragile skin.

Or that was the case, at least, until scientists discovered that they could harness UVC to kill microorganisms. Since the finding in 1878, artificially produced UVC has become a staple method of sterilisation – one used in hospitals, airplanes, offices, and factories every day. Crucially, it's also fundamental to the process of sanitising drinking water; some parasites are resistant to chemical disinfectants such as chlorine, so it provides a failsafe.

Though there hasn't been any research looking at how UVC affects Covid-19 specifically, studies have shown that it can be used against other coronaviruses, **such as Sars**. The radiation warps the structure of their genetic material and prevents the viral particles from making more copies of themselves.

However, it's not quite as good as we might have hoped. In a recent study – which looked at whether UVC could be used to disinfect PPE – the authors found that, while it is possible to kill the virus this way, in one experiment it needed **the highest exposure out of hundreds of viruses that have been looked at so far**. The amount of ultraviolet required varied widely, depending on factors such as the shape and type of material the virus was on.

Nevertheless, a concentrated form of UVC is now on the front line in the fight against Covid-19. In China, whole buses are being **lit up by the ghostly blue light each night**, while squat, UVC-emitting robots have been **cleaning floors** in hospitals. Banks have even been using the light to **disinfect their money**.

out of 238 (0.4%) was positive after UVC-treatment (the computer keyboard) at 254 nm emitted by 3 connected devices run for 45 min. Wong et al. reported the persistence environmental contamination by methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant Enterococcus (VRE) and *C. difficile*, respectively in 27%, 29,5%, and 22,7% of sites after the standard cleaning and disinfection protocol, whereas only in 3.3%, 4.9%, and 0% after UVC-disinfection ($p < 0.05$). The exposition time varied from 14 min at 46,000 μWs/cm^2 to 57 min at 22,000 μWs/cm^2 for the sporicidal cycle. The ability to disinfect high concentrations of organisms varies in the presence of proteins [16]. The same finding was reported by Ali et al., who observed lower and more variable $\log_{10}$ reductions in MRSA and *K. pneumoniae* after UVC disinfection at 254 nm when heavy soiling was present [17].

An increased reduction of 17% in MRSA, VRE, *Acinetobacter* spp., and carbapenem-resistant Enterobacteriaceae was reported by Hosein after 20 min pulsed xenon-based ultraviolet light disinfection (one device, two cycles) in addition to standard end-of-day manual cleaning [18].

Haddad et al. showed that combining standard between-case manual cleaning of surfaces, followed by a 2-min cycle of disinfection using a portable xenon pulsed ultraviolet light germicidal device, furtherly decreased the bacterial load by at least 70% [19]. The effectiveness of the pulsed xenon-based ultraviolet light systems in reducing aerobic bacteria, also in the absence of manual disinfection, was demonstrated by Jinadatha et al. [20].

Although some studies have reported doses of UVC that yield 3 $\log_{10}$ reductions of specific pathogens using low-pressure mercury lamps UVC devices, data regarding spectrophotometrically determined doses of 200–320 nm light emitted by pulsed xenon lamps are lacking [21].

Hospitals that use UV-light disinfection after cleaning and disinfection standard protocol have actually significantly mitigated infection risks associated with environmentally mediated transmission routes. In the BETR (Benefits of Enhanced Terminal Room Disinfection) study, the first randomized multicenter trial that compared the effectiveness of different disinfection strategies in rooms previously occupied by colonized/infected patients with the incidence of new colonization and infections in new hospitalized patients, demonstrated that the addition of UVC disinfection treatment to the standard protocol had a direct protective effect on the risk of acquiring *C. difficile* and vancomycin-resistant Enterococci [22,23].

The prevalence of infectious diseases caused by multidrug-resistant microorganisms is relentlessly increasing worldwide owing to the excessive use of antibiotics [1]. Recently, a dangerous new mutation (named NDM-1) [2] that makes some bacteria resistant to almost all antibiotics has been found in the USA in patients with urinary tract infections [3]. Antibiotic resistance has led to a major research effort to find alternative antimicrobial approaches to which, it is hypothesized, microorganisms will not be easily able to develop resistance.

Ultraviolet (UV) irradiation is electromagnetic irradiation with a wavelength (100–400 nm) shorter than that of visible light (400–700 nm), but longer than x-rays (<100 nm) (Figure 1). UV irradiation is divided into four distinct spectral areas including vacuum UV (100–200 nm), UVC (200–280 nm), UVB (280–315 nm) and UVA (315–400 nm) (Figure 1) [4]. The mechanism of UVC inactivation of microorganisms is to damage the genetic material in the nucleus of the cell or nucleic acids in the virus [5]. The UVC spectrum, especially the range of 250–270 nm, is strongly absorbed by the nucleic acids of a microorganism and, therefore, is the most lethal range of wavelengths for microorganisms. This range, with 262 nm being the peak germicidal wavelength, is known as the germicidal spectrum [6]. The light-induced damage to the DNA and RNA of a microorganism often results from the dimerization of pyrimidine molecules. In particular, thymine (which is only found only in DNA) produces cyclobutane dimers. When thymine molecules are dimerized, it becomes very difficult for the nucleic acids to replicate and if replication does occur it often produces a defect that prevents the microorganism from being viable.

Although it has been known for the last 100 years that UVC irradiation is highly germicidal, the use of UVC irradiation for prevention and treatment of localized infections is still in the very early stages of development. Most of the studies are confined to *in vitro* and *ex vivo* levels, while *in vivo* animal studies and clinical studies are much rarer. Studies that have examined UVC inactivation of antibiotic-resistant bacteria have found them to be as equally susceptible as their naive counterparts [7]. Within the UVC range, 254 nm is easily produced from a mercury low-pressure vapor lamp and has been shown to be close to the optimal wavelength for germicidal action. Because the delivery of UVC irradiation to living tissue is a localized process, UVC for infectious diseases is likely to be applied exclusively to localized infections.

In this review, we will discuss the potential of UVC irradiation as an alternative approach to localized infections. The topics include the efficacy of UVC for localized infections, effects of UVC on wound healing, effects of UVC on mammalian tissue and cells, and the possibility of the resistance development of microorganisms to UVC. To the best of our knowledge, this is the first comprehensive review on UVC for localized infections.

Source:
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