Medical letter

Air decontamination equipment

Scientific reasoning

Airborne-mediated microbial diseases represent one of the major challenges to worldwide public health. Common examples are *Influenza virus* appearing in seasonal and pandemic forms like SARS-CoV-2 virus which determine the respiratory disease COVID-19 that has caused outbreaks worldwide.

The SARS-CoV-2 is a new variant in the betacoronavirus family (Fisher 2020). It transmits by direct contact or contact with fomites and can be suspended in air as well, as are the related betacoronaviruses SARS, MERS, and the four known human coronaviruses – OC43, 229E, NL63 and HKU1 (Purple Sun 2020). COVID-19 is highly contagious and so any residual contamination, no matter how small, can pose a threat to healthcare workers and patients.

Coronaviruses (CoVs) have been traditionally considered nonlethal pathogens to humans, mainly causing approximately 15% of common colds. However, in this century, we have encountered highly pathogenic human CoVs twice, *i.e.*, SARS-CoV and MERS-CoV, which caused an outbreak originally in China in 2003 and Saudi Arabia in 2012, respectively, and soon spread to many other countries with increased morbidity and mortality.

Therefore, the current COVID-19 is the third CoV outbreak in the recorded history of humans. (Ye Yi, Philip N.P. Lagniton et. al, 2020)

CoVs are a subfamily of large and enveloped viruses containing a single strand of sense RNA. They can be divided into four genera, *i.e.*, alpha, beta, gamma and delta, of which alpha – and beta-CoVs are known to infect humans.

The envelope spike glycoprotein binds to its cellular receptors angiotensin-converting enzyme 2 (ACE2) and dipeptidyl peptidase 4 (DPP4) for SARS-CoV and MERS-CoV, respectively, and then membrane fusion occurs.

The viral RNA genome is released into the cytoplasm; after replication of the viral genome, genomic RNA accompanied by envelope glycoproteins and nucleocapsid proteins forms virion-containing vesicles, which then fuse with the plasma membrane to release the virus. (Ye Yi, Philip N.P. Lagniton et. al, 2020).

The researches results showed that the genomic sequences of SARS-CoV-2 and SARS-CoV have extremely high homology at the nucleotide level. It has been reported that SARS-CoV-2 shared almost 80% of the genome with SARS-CoV. The studies of Jiabao Xu and Shizhe Zhao from School of Basic Medical Sciences Henan University, China, in collaboration with Department of Clinical Laboratory Sciences, College of Applied Medical Sciences, Jouf University, Saudi Arabia and Department of Anesthesia, Stanford

University, also showed that almost all encoded proteins of SARS-CoV-2 are homologous to SARS-CoV proteins.

Hence, clinical drugs, therapies for treating SARS and methods used for aerogen and surfaces decontamination may be used as a reference for COVID-19 management.

Ultraviolet light can be an effective measure for decontaminating surfaces that may be contaminated by the SARS-CoV-2 virus by inducing photodimers in the genomes of microorganisms. Ultraviolet light has been demonstrated to be capable of destroying viruses, bacteria and fungi in hundreds of laboratory studies. (Kowalski 2009)

The SARS-CoV-2 virus has not yet been specifically tested for its ultraviolet susceptibility but many other tests on related coronaviruses, including the SARS coronavirus, have concluded that they are highly susceptible to ultraviolet inactivation.

For all these reasons, ASHRAE organisation recommends ultraviolet germicidal irradiation as one strategy to address COVID-19 disease transmission. (ASHRAE 2020)

Technical solution

The proposed technical solution involves an UV-C radiation source (253,7 nm) capable of decontaminating the air at the exit of the device from any potential pathogens.

Equipment is designed for 99,99% decontamination against SARS-CoV-2 virus, for a maximum air flow of 2000 m^3/h.

It has a simple design, works independently, can be mounted in every kind of room and was designed to be used in closed spaces where people have access. The equipment is designed and constructed in such a way that UV-C radiation does not affect users.

According to medical and UV-C radiation publications as well as the documentation of the equipments listed in table 1, we hereby confirm that they have been analyzed and comply with the requirements in terms of decontamination and safety of their use in spaces with human presence.

No.	Product code	Airflow	Power [W]
1	ADE2150	150 m^3 / h	84
2	ADE3250	250 m^3 / h	126
3	ADE4500	500 m^3 / h	168
4	ADE6650	650 m^3 / h	252
5	ADE101000	1000 m^3 / h	436
6	ADE141500	1500 m^3 / h	714
7	ADE182000	2000 m^3 / h	954

Table 1

In fact, the potential use of ultraviolet light for airborne disinfection is by no means new, and was first demonstrated more than 80 years ago. The usage of this air decontamination equipment, which is safe for human exposure, could provide the desired antimicrobial benefits without the accompanying human health concerns of conventional germicidal lamp UVGI.

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