

Summary of disinfection technologies for microbial control

SAGE – Environmental and Modelling Group 18052020

Overview

This paper summarises evidence for ultraviolet (UV) disinfection, visible light, local air filtration and fumigation technologies to be applied to control COVID-19 transmission.

Supporting evidence is presented in a companion paper “Application of UV disinfection, visible light, local air filtration and fumigation technologies to microbial control”

Key findings are:

1. There is good evidence that germicidal UV (GUV) that uses UV-C light and fumigation approaches (particularly Hydrogen Peroxide Vapour (HPV)) are likely to be viable decontamination approaches against SARS-CoV-2 for unoccupied rooms. Both are widely available as commercial systems and are already used in many hospitals for terminal disinfection. UV-C is more challenging to apply well in a complex space with surfaces in shadow but ‘shadowing’ effects can also affect fumigation efficacy, with areas facing away from delivery equipment or positions on the underside of room surfaces the most challenging to reach.
2. Both UV-C and fumigation decontamination require a sufficient duration of exposure to be effective. As such they are more likely to be effective as part of a terminal cleaning process rather than daily disinfection. This is particularly the case for fumigation which requires 30-90min cycle time, plus time for aeration to remove of any excess fumigants. UV carousel devices are typically deployed for between 20 and 45 minutes, depending on the room to be treated, but may also require moving and repeat treatment to overcome shadowing effects. Removal of fumigant by aeration is a particular concern for fumigation approaches that should be considered particularly in environments with a high level of soft furnishings.
3. There is good evidence that upper room GUV has good potential to be used effectively to reduce microbial load in the air in occupied rooms, although there is limited evidence for application against respiratory viruses in a real-world setting. The technology is only suitable in rooms with a high enough ceiling and is most effective in poorly ventilated spaces. It should not be seen as an alternative to ventilation but is likely to be beneficial where ventilation can't be improved. An upper room GUV system needs to be sized correctly for the size of the room and the microorganism, and needs to consider the interaction with the ventilation flow.
4. Local air cleaning devices, including filter devices and UV-C devices – which may be found in combination - are unlikely to have significant benefit unless the airflow rate

through the device is sufficient. There may be some poorly ventilated spaces where these may be useful.

5. Far-UV technology is promising as a control but is far too early in development to be applied in real-world settings without significant further research. There is some evidence that visible light or blue/violet (HINS) light may be effective in reducing bacterial contamination in buildings, but there is very weak evidence for the effect on viruses. Enhancing natural light in buildings (e.g opening blinds) is a no cost precautionary measure where good light ingress already exists, but it is unlikely to have more than a marginal benefit. The benefits of HINS light are worthy of further research as this has been developed to a level that it has been applied in hospitals.
6. Both UV-C and fumigation decontamination approaches have significant safety considerations and should only be carried out by trained staff with appropriate risk assessments and controls in place. Upper room GUV has significant safety considerations which must be taken into consideration in the design, installation and operation.
7. We have not considered the cost-effectiveness of any of these approaches, This would need to be considered alongside enhancing conventional strategies such as improving ventilation and increasing standard cleaning approaches to determine whether there is additional benefit to be gained from applying disinfection technology.
8. The approaches detailed in this paper should never be regarded as a substitute for good cleaning or good ventilation. They are technologies that could be used to supplement conventional methods but not to replace them. Importantly, chemical fumigation and UV based room treatments should be regarded as disinfection processes, not as sterilization, regardless of supplier claims.