Far-UVC light can virtually eliminate airborne virus in an occupied room, study shows

April 2 2024

Overhead lamps emitting far-UVC (222-nm) light were employed to reduce levels of an airborne virus in an occupied room. Credit: David Welch, Columbia University Irving Medical Center

Far-UVC light is a promising new technology for reducing airborne virus levels in occupied indoor spaces, but its effectiveness has not been evaluated in real-life scenarios.

A study by Columbia researchers now shows that far-UVC light inactivated nearly all (greater than 99%) of an airborne virus in an occupied work environment, showing that the technology can work as well in a real-life scenario as in the laboratory. The paper is published in the journal *Scientific Reports*.

"The results show that far-UVC is highly effective at reducing airborne pathogens in an ordinary occupied room, and so it's practical to use far-UVC light in indoor areas where people are going about their business," says David Brenner, Ph.D., director of the Center for Radiological Research at Columbia University Vagelos College of Physicians and Surgeons and senior author of the study.

"If this virus had been a disease-causing virus, the far-UVC light would have provided far more protection against airborne-disease transmission than any ventilation system," says Brenner.

A new air disinfection technology

Conventional germicidal UVC light is a well-known technology for killing viruses and bacteria and is frequently used by hospitals to sterilize rooms. However, direct exposure to conventional germicidal UVC light can potentially harm skin and eyes, so it can only be turned on when a room is empty.

"You can decontaminate a room in the morning before people arrive, but it can quickly become contaminated again because people in the room are shedding viruses and other airborne pathogens," Brenner says. "The goal is to be able to continuously decontaminate a room while people are

in it."

Over the past few years, Brenner's team has been developing far-UVC light, which has a shorter wavelength (222-nm) than conventional germicidal UVC light and cannot penetrate or damage living skin or eyes. Laboratory tests at Columbia and other centers have demonstrated that far-UVC quickly and efficiently inactivates airborne pathogens in both small and room-sized test chambers.

A real-world test

In the new study, the researchers wanted to look at the impact of far-UVC light in a room where both people and high levels of virus in the air are present. For ethical and safety reasons, the virus had to be harmless to humans.

At Columbia, a room where laboratory mouse cages are cleaned provided an ideal test setting. Most mice carry a form of norovirus that doesn't make the animals—or humans—sick, but high concentrations of the virus become airborne when the cages are cleaned.

The researchers installed four overhead far-UVC lamps in the cage cleaning room and collected daily air samples to compare infectious virus levels on days when the lamps were turned on and days when the lamps were turned off. (The lamps were in compliance with current regulatory guidance on far-UVC exposure limits.)

Efficacy surpasses expectations

"Based on our initial sensitivity tests, we expected to see a reduction in airborne virus of around 66%," says Brenner.

The result—a reduction in infectious airborne viruses of 99.8%—surpassed expectations and was far greater than what could be achieved by typical air filtration and ventilation.

The study did not find any measurable difference in air quality (ozone or particulates) associated with far-UVC illumination.

Far-UVC lamps are being installed in more public locations, with corresponding measurements of the reduction in airborne pathogens. Brenner's team is also performing laboratory studies to directly quantify the effect of far-UVC light on airborne disease transmission.

More information: Manuela Buonanno et al, 222 nm far-UVC light markedly reduces the level of infectious airborne virus in an occupied room, *Scientific Reports* (2024). DOI: 10.1038/s41598-024-57441-z

Provided by Columbia University Irving Medical Center