UV radiation kills coronavirus in lab, study finds

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A specific wavelength of ultraviolet radiation killed more than 99.99% of SARS-CoV-2, the virus that causes COVID-19, in laboratory tests, a new study has found.

The results could offer an encouraging option for inactivating the virus that causes COVID-19 from surfaces or, potentially, from the air. It is

the first study to demonstrate that specific doses of UV222, a relatively short wavelength of ultraviolet radiation, may be a feasible and safe approach to disinfecting COVID-19.

The study appears on a preprint server and has not yet undergone a formal peer review by other scientists.

"The special thing is that this wavelength is effectively absorbed by the SARS-CoV-2 genome and the proteins of the virus," said Natalie Hull, lead author of the study and assistant professor of civil, environmental and geodetic engineering at The Ohio State University. "And because of that, it was likely able to damage the proteins that perpetuate the virus infection cycle. And we think that's why this is so effective."

The findings mean that UV222 could be a safe way to disinfect spaces contaminated by COVID-19, the researchers said.

"This is the first time anyone has done something with the real virus, and as best we can tell, this is a wavelength that's safe for humans," said Richard Robinson, co-author of the study and associate professor of microbial infection and immunity at Ohio State. "And so theoretically, this could be a way of decontaminating that would be safer for people, and would also kill the virus."

There are caveats to the study. The findings, while encouraging, are "a starting point," Hull said. The researchers tested the effectiveness of UV to destroy SARS-CoV-2 in a liquid solution, which is usually a more difficult medium to disinfect than air.

But the study did not test UV222's ability to kill the virus in the air or on non-liquid surfaces, and any real-world solution to fighting the virus in spaces where people live, work or play must be effective in those spaces. An open room would include other factors not tested in this study,

including varying temperatures, humidity and air flow, Hull said.

She said the UV light destroys the proteins and nucleic acids that make up the virus, essentially disabling it. Destroying the proteins and nucleic acids makes it impossible for the virus to replicate and complete the cycles necessary to infect people.

"It's basically like scrambling a protein with heat," Hull said. "You're applying energy and it breaks the bonds to change the structure. And these cell processes responsible for replicating the genome and making more virus components or binding to the host cell don't happen in the same way, so it halts the infection cycle."

The researchers knew that ultraviolet radiation could inactivate coronaviruses, a broad category of viruses that includes SARS-CoV-2. (The common cold, for example, is also a coronavirus; UV radiation has been shown to destroy it as well.) But most commercially available UV lamps emit rays that are long enough to penetrate skin, making them a potential cancer risk. And little information is known about how much UV radiation is necessary to kill SARS-CoV-2.

UV222 is a shorter wavelength of ultraviolet radiation than the rays that reach people from the sun, and previous studies have shown that UV222 is not likely to cause skin cancer and other health problems associated with UV radiation. (The "222" refers to the size of the wavelength—222 nanometers. These wavelengths from the sun are mostly consumed by Earth's atmosphere before they reach us.)

The study was performed on samples of the COVID-19-causing virus that were cultivated and reproduced in a special laboratory on Ohio State's campus designed to manage biologically dangerous pathogens and viruses. The research team obtained the samples from the Biodefense and Emerging Infections Research Resources Repository, an arm of the

National Institute of Allergy and Infectious Diseases.

Researchers directed UV222 at samples of the virus held in a liquid suspension, then tested to see how much of the virus was destroyed and how long the UV radiation took to destroy it. They tested times ranging from 15 seconds to 15 minutes.

Robinson, who has studied tuberculosis and other lung pathogens and who is associate director of Ohio State's Biosafety Level 3 lab where the tests were conducted, said he was overwhelmed by what they saw: A near-total destruction of the virus, after only a few minutes.

"When we started these experiments last summer, it was at the time when nothing was working to stop COVID," Robinson said. "And this was so rewarding, because immunologists were still unsure what to do and here was this thing where we could just zap the virus and see this immediate effect."

Hull and Robinson intend to continue testing UV222 in real-world conditions, and Hull said she is optimistic.

"We found the virus is really wimpy when confronted with UV222," she said. "And our findings are a conservative estimate—liquid is this nice place where the virus is much happier than in a room full of air. We don't know for sure, but I think it's reasonable to think it might work in the air, too. We need to do the experiments to find out for sure."

More information: Richard T. Robinson et al. SARS-CoV-2 disinfection in aqueous solution by UV222 from a krypton chlorine excilamp, (2021). DOI: 10.1101/2021.02.19.21252101

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