



# Sustainability of Coronavirus on Different Surfaces

Rajiv Suman\*, Mohd Javaid†, Abid Haleem‡, Raju Vaishya‡, Shashi Bahl§, Devaki Nandan\*

\*Department of Industrial & Production Engineering, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India,

†Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi, India, ‡Department of Orthopaedics, Indraprastha Apollo Hospital,

Sarita Vihar, Mathura Road, 110076, New Delhi, India and §Department of Mechanical Engineering, I. K. Gujral Punjab Technical University Hoshiarpur Campus, Punjab, India

**Coronavirus disease 2019 (COVID-19) is the name of the disease supposedly manifested in December 2019 from Wuhan, from the virus named SARS-CoV-2. Now, this disease has spread to almost all other parts of the world. COVID-19 pandemic has various reasons for its dramatic worldwide increase. Here, we have studied coronavirus sustainability on various surfaces. Various disinfectants and their roles are discussed from the available literature. The infection capabilities of SARS-CoV-1 and SARS-CoV-2 for different materials and finally studies on infection decay for SARS-CoV-1 and SARS-CoV-2 are discussed. (J CLIN EXP HEPATOL 2020;10:386–390)**

The global disaster COVID-19 pandemic has various reasons for its dramatic increase worldwide. Some researchers opine that the SARS-CoV has its origin from bats and the prevalence of this virus to humans was through palm civets: the intermediate source between bats and human population.<sup>1,2</sup> The most responsible reasons for it include the large human population gathering and human intervention which have violated the ecosystem globally. The population of the world intrudes the various untouched ecologies and put themselves before the unknown viruses and bacteria without knowing their threat or impact of exposure to humankind.<sup>3,4</sup>

The coronavirus can travel beyond species boundaries. The earliest infection of SARS-CoV-2 was in Wuhan (China), and the World Health Organization (WHO) has called this pandemic as Coronavirus disease 2019 (COVID-19). Initially, it was thought that this virus also has its origin from the animals to humans, as some of the infected people were from a wholesale seafood market in Wuhan. At a later stage, infections were found in humans, those who have not even visited that particular market, thus making it clear that this virus can also spread by human-to-human exposure.<sup>5–7</sup>

There can be various ways of transmission for this virus to infect the human population. Spreading or transmission of COVID-19 can be through close contact of human beings or by touch or the aerosol spreading of the virus.<sup>8–10</sup> The most common way of spreading of this virus is through respiratory droplets as the infected one coughs or sneezes. These microdroplets containing the virus can infect a healthy human by settling on the face (mouth,

nose, ears, eyes) or hands.<sup>11</sup> This virus can sustain for a long time on various surfaces which is also considered as a significant reason for its transmission. Frequent touching of the facial area, handshake and unavoidable touch to different surfaces while travelling (through various transport means) are also a significant threat to humans. In addition, the transmission is known as “hidden transmission” as the carrier unknowingly spreading the infection to other population exists.<sup>12</sup>

## CORONAVIRUS SUSTAINABILITY ON VARIOUS SURFACES

Coronavirus can last for long durations on different metal surfaces, ranging from hours to days.<sup>13,14</sup> Recent studies show that the coronavirus can last about three days on a plastic surface as well as on stainless steel surface, it can also sustain for a period of whole one day on cardboard, while it can only sustain only for about four hours on a copper surface.<sup>15</sup>

## DISINFECTANTS/SANITISERS AND THEIR ROLE

The use of disinfectants decimates microorganisms such as virus or bacteria on inner layers or inert surfaces by acting as an antimicrobial agent. Disinfectants are not always impressive against all kinds of microorganism such as bacterial spores unlike sterilisation, which kills all types of microorganisms by the use of extreme physical or chemical procedures.<sup>16</sup> Disinfectants play a critical role in decimating microorganisms outside the human body or on various surfaces. This fact distinguishes disinfectants from antibiotics and antiseptics, which act inside the human body or on living tissues, respectively. The mechanism of disinfection involves the destroying of the cell wall of microbes and the disinfectant enters into their metabolism to destroy or inactivate them.

**Keywords:** COVID-19, SARS-CoV-1, SARS-CoV-2, sustainability, surfaces TCID

Received: 11.4.2020; Accepted: 28.4.2020; Available online 6 May 2020

Address for correspondence.

E-mail: [raje.suman@gmail.com](mailto:raje.suman@gmail.com)

<https://doi.org/10.1016/j.jceh.2020.04.020>

millilitre of medium with time. The green line shows the linear decay of infection capability in the graphs. Graphs for both SARS-CoV-2 and SARS-CoV-1 are confined from 1 to 5 digits; these digits depict the five environmental conditions, namely, (1) aerosol, (2) plastic, (3) stainless steel, (4) copper and (5) cardboard.

## CONCLUSION

Coronavirus can sustain for a long time on various surfaces which is a major reason for its transmission. This virus can contaminate on different metal surfaces and stay on them from hours to days, with a maximum span on plastic and stainless and least on the copper surface. **The alcohol-based disinfectants can significantly reduce the survival and decay time of the virus.** The two important coronaviruses (SARS-CoV-2 and SARS-CoV-1) have significant sustaining time on different metal surfaces, and their behaviour is almost similar on various metal surfaces and in aerosols.

## CREDIT AUTHOR STATEMENT

**Dr Rajiv Suman:** Concept, writing some part and revision of the paper. **Dr Mohd Javaid:** Concept and writing some part of the paper. **Prof. Abid Haleem:** Writing some part and checked whole paper. **Prof. Raju Vaishya:** Writing some part and checked whole paper. **Dr Shashi Bahl:** Writing some part of the paper. **Devaki Nandan:** Revision of the paper.

## CONFLICTS OF INTEREST

The authors have none to declare.

## REFERENCES

- Smith KF, Goldberg M, Rosenthal S, et al. Global rise in human infectious disease outbreaks. *J R Soc Interface*. 2014;11:20140950.
- Carroll D, Daszak P, Wolfe ND, et al. The global Virome Project. *Science*. 2018;359:872–874.
- Lau SK, Li KS, Huang Y, et al. Ecoepidemiology and complete genome comparison of different strains of severe acute respiratory syndrome-related Rhinolophus bat coronavirus in China reveal bats as a reservoir for acute, self-limiting infection that allows recombination events. *J Virol*. 2010;84:2808–2819.
- Li W, Shi Z, Yu M, et al. Bats are natural reservoirs of SARS-like coronaviruses. *Science*. 2005;310:676–679.
- Lu H, Stratton CW, Tang YW. Outbreak of pneumonia of unknown etiology in wuhan China: the mystery and the miracle. *J Med Virol*. 2020;92:401–402.
- Ji W, Wang W, Zhao X, Zai J, Li X. Cross-species transmission of the newly identified Coronavirus 2019-nCoV. *J Med Virol*. 2020;92:433–440.
- Haleem A, Javaid M, Vaishya. Effects of COVID 19 pandemic in daily life. *Curr Med Res Pract*. 2020 <https://doi.org/10.1016/j.cmrp.2020.03.011>.
- Organisation, W.H., Consensus Document on the Epidemiology of Severe Acute Respiratory Syndrome (SARS). 2003, World Health Organization: Geneva.
- Maier HJ, Bickerton E, Britton P. *Coronaviruses: Methods and Protocols*. Berlin: Springer; 2015:1–282.
- Malik M, Elkholy AA, Khan W, et al. Middle East respiratory syndrome coronavirus: current knowledge and future considerations. *EMHJ-Eastern Mediterr Health J*. 2016;22:533–542.
- Lu CW, Liu XF, Jia ZF. 2019-nCoV transmission through the ocular surface must not be ignored. *Lancet*. 2020;395:e39.
- Chan JF, Yuan S, Kok KH, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *Lancet*. 2020;395:514–523.
- Q & A on Covid-19". European Centre for Disease Prevention and Control. Archived from the Original on 5 February 2020. Retrieved 23 March 2020.
- Nishiura H, Linton NM, Akhmetzhanov AR. Initial cluster of novel coronavirus (2019-nCoV) infections in Wuhan, China is consistent with substantial human-to-human transmission. *J Clin Med*. 2020;9:488.
- Moriyama M, Hugentobler WJ, Iwasaki A, March. Seasonality of respiratory viral infections. *Ann. Rev. Virol*. 2020;7 <https://doi.org/10.1146/annurev-virology-012420-022445>. PMID 32196426.
- Division of Oral Health - Infection Control Glossary". U.S. Centers for Disease Control and Prevention. Archived from the Original on 13 April 2016. Retrieved 9 April 2019.
- Robertson OH, Bigg E, Puck TT, Miller BF. The bactericidal action of propylene glycol vapor on microorganisms suspended in air. *J Exp Med*. June 1942;75:593–610.
- Disinfection & Sterilisation Guidelines. *Guidelines Library: Infection Control*. CDC. In: Archived from the Original on 12 January 2018. 28 December 2016. Retrieved 12 January 2018.
- Food Safety A to Z Reference Guide-B" FDA CFSAN. Archived from the Original on 3 January 2006. Retrieved 10 September 2009.
- Moorer WR, August. Antiviral activity of alcohol for surface disinfection. *Int J Dent Hyg*. 2003;1:138–142.
- van Engelenburg FA, Terpstra FG, Schuitemaker H, Moorer WR. The virucidal spectrum of a high concentration alcohol mixture. *J Hosp Infect*. 2002;51:121–125.
- Lages SL, Ramakrishnan MA, Goyal SM, February. In-vivo efficacy of hand sanitisers against feline calicivirus: a surrogate for norovirus. *J Hosp Infect*. 2008;68:159–163. <https://doi.org/10.1016/j.jhin.2007.11.018>. PMID 18207605.
- chlorine as disinfectant for water. Retrieved 12 December 2019 [www.lenntech.com](http://www.lenntech.com).
- Cleaning". Food Standards Agency. Retrieved 9 April 2020, Mid Sussex District Council, U.K.
- Green Cleaning, Sanitizing, and Disinfecting: A Curriculum for Early Care and Education" (PDF). Retrieved 9 April 2019.
- van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med*. 2020 Mar 17.
- Q&A on coronaviruses. Archived from the Original on 20 January 2020. World Health Organization; 11 February 2020. Retrieved 24 February 2020.
- Coronavirus Disease 2019 (COVID-19)—Transmission Archived from the Original on 23 March 2020.. Centers for Disease Control and Prevention; 17 March 2020. Retrieved 23 March 2020.
- Coronavirus Disease (COVID-2019) Situation Reports. Geneva: World Health Organization; 2020 <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/>.