भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

PRESS RELEASE

IIT Hyderabad's Researchers predicted the lifetime of SARS-COV-2 droplets in different environmental conditions

Under the same environmental conditions, the drying time for droplets on a smartphone screen is three times longer than that on a normal glass surface.

HYDERABAD, 22nd February 2021: Interdisciplinary research group of faculty at Indian Institute of Technology Hyderabad have predicted the lifetime of SARS-CoV-2 droplets on surfaces in different environmental conditions, such as ambient temperature, relative humidity, and volume and composition of droplets. Respiratory infections such as the SARS-CoV-2 virus spreads primarily by respiratory droplets (size > 10µm) of saliva or discharge from the nose of an infected person during coughing/sneezing. Fluid dynamics plays an important role in the study of the life of these droplets migrating in the air or deposited on surfaces.

Key outcomes of the study:

- Spread of virus is minimal after drying of droplets containing virus. The study focuses on various factors affecting the drying time of saliva droplets whereas earlier studies were based on water droplets.

- Saliva droplets consist of salt, protein (mucin), and surfactant (dipalmitoylphosphatidylcholine) in addition to water. These ingredients delay the evaporation of respiratory droplets significantly as compared to pure water droplets.

- Increase in humidity will make the droplet to take longer than an hour compared to a droplet under a lower humid environment that will dry-up in minutes.

- Lower ambient temperature also increases the drying time of the droplet.

- The angle made by a droplet on the surface (which is known as "contact angle") plays important role in the drying time of the droplet and hence highly hydrophilic surfaces may be less susceptible to prolonged contamination.

Saliva droplets consist of salt, protein (mucin), and surfactant (dipalmitoylphosphatidylcholine) in addition to water as reported in the earlier study published in the Journal of Royal Society Interface. By conducting a theoretical and numerical study, Dr. Saravanan Balusamy, Dr. Sayak Banerjee From Dept of Mechanical & Aerospace Engineering and Prof. Kirti Chandra Sahu from Dept of Chemical Engineering of IITH showed that these ingredients delay the evaporation of respiratory droplets significantly as compared to pure water droplets. The work appears in the International Communications in Heat and Mass Transfer, a leading journal in this field.

Dr. Saravanan Balusamy said *"A simple classical theoretical model developed in this study that takes into account the dynamic contact angle and the insoluble surfactants is capable of accurately predicting the evaporation time under different conditions."*

"The time taken by saliva droplets to dry up also depends on the nature of the surface material on which it falls as it dictates how far the droplet spreads out", said **Dr. Sayak Banerjee**.

Speaking about the findings of their study, Prof. Kirti Chandra Sahu, said, "*While the lifetime of a small saliva droplet of size 1 nanolitre is less than a 1 minute, a normal size saliva droplet of 10 nanolitres takes more than 15 minutes to evaporate at room temperature and relative humidity of 50 per cent. For high relative humidity, say of greater than 90 per cent, the droplet stays live on the surface for significantly longer, about an hour. Of course, viruses could still be alive in dried droplets, which requires further research involving biologists."*

The longest drying times are observed with the combination of low ambient temperature and high relative humidity, while the drying time progressively reduces as the humidity falls and the temperature rises. Researchers also found that for a fixed initial volume of the droplet, increasing the initial contact angle increases the drying time. This follows physical intuition, as a droplet with a smaller contact angle has a greater wetting radius and surface area for the same volume resulting in a larger interface area over which the diffusion-driven evaporation can occur. Thus, highly hydrophilic surfaces may be less susceptible to prolonged contamination in comparison to less hydrophilic surfaces, which is somewhat a counter-intuitive result.

The study conducted by IITH faculty shows the importance of properly sanitising the contact prone surfaces in different seasons and air-conditioned indoor areas and suggest to follow World Health Origination (WHO) guidelines, such as wearing face masks and maintaining social distance as the preventive measures for air transmission of COVID-19.

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About IIT Hyderabad

Indian Institute of Technology Hyderabad (IITH) is one of the six new Indian Institutes of Technology established by the Government of India in 2008. In a short span of **12** years, the institute built on an imposing **600**-acre campus and has been ranked among the top **10** institutes for four consecutive years in the NIRF released by the Ministry of Education, GoI. IITH was also ranked under Top **#20** in the recent edition ARIIA on indicators related to 'Innovation and Entrepreneurship Development' among students and faculties. IIT Hyderabad has close to **237** full-time faculty, **3,397** students of whom **20** per cent are women, nearly **200** state-of-the-art laboratories and five research and entrepreneurship centres. The Institute has a strong research focus with more than Rs. **500** crore of sanctioned research funding while PhD scholars account for about **30%** of total student strength. IITH students and faculty are at the forefront of innovation with more than **1,500** research publications and patent disclosures, **300** sponsored/ consultancy projects and **50** industry & academic collaborations.

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