

Silver nanoparticles based superhydrophobic anti-viral coating on cloth

Prof. Aditya Kumar, Kalpita Nath, Poonam Chauhan
Department of Chemical Engineering
IIT (ISM) Dhanbad

In COVID-19 pandemic situation, the use of triple layered mask and PPE kits are recommended by WHO to protect people from infection. However, these PPE kits can only be used one time and health care workers get infected while removing PPEs and also during disposal of the infected PPEs. Additionally, it is not easy to work with PPE kits put on over multilayered clothing, particularly, in hot and humid seasons. If, however, the clothes themselves are made anti-bacterial and anti-viral, then multi-layered clothing and full body cover PPE kits will not be needed. Also the spread of the virus by transferring from one surface to the other will get reduced considerably.

With above in mind, we at IIT(ISM) Dhanbad, have developed a method to prepare a facile and durable superhydrophobic coating of silver nanoparticles on the surface of cloth using an in-situ UV irradiation method followed by its modification with the perfluorodecyltriethoxysilane. Superhydrophobicity is a phenomenon which shows that the water droplet does not stick to the surface at all and rolls off easily from it. At lab-scale, this coating is found to have excellent chemical and thermal stability making it reusable multiple times even after repeated washing. The coated cloth exhibits exceptional self-cleaning and stain resistant properties leading to complete non-adherence of dirt, liquid droplets and stain (for example, food, rust, ink, etc.) on the cloth surface.

Anti-bacterial and anti-fungal properties of the coated cloth were confirmed by carrying out *E. coli* (bacteria) and *A. niger* (fungus) culture studies, respectively. This coating is imbued with silver nanoparticles, which is a proven anti-viral agent. It inhibits the attachment of the virus on the surface of the cell itself. As shown in the **Figure 1**, when microbes come in contact with the coated cloth, they are repelled by the superhydrophobic nature of the coating. If they somehow touched the cloth surface, they get killed by Ag⁺ (silver) ions present in the coating. Ag⁺ ions strongly inhibit microbial growth through suppression of the respiratory enzymes and electron transport components and interference with the DNA functions.

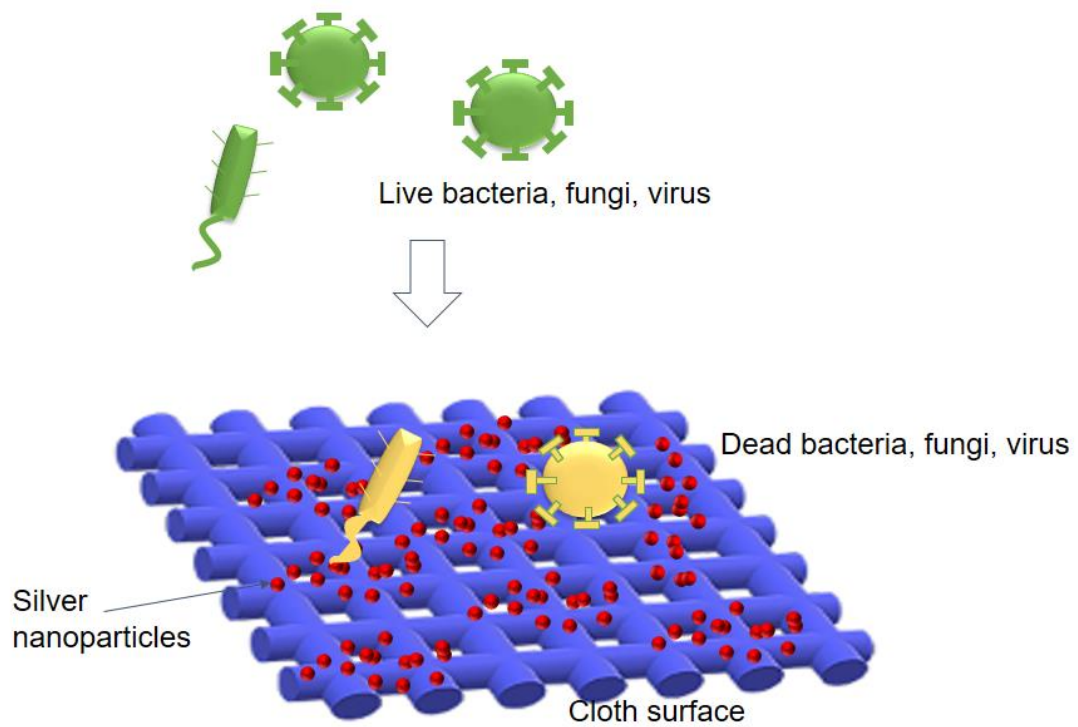


Figure 1: Mode of action of silver nanoparticles based superhydrophobic coating to kill the microbes like bacteria, fungi and virus.

Since silver is also nontoxic in nature to humans at very low concentrations, the silver nano-particle coating becomes human friendly. The superhydrophobic nature of the coating combined with the anti-viral agent silver, makes it a potential anti-COVID-19 coating. Currently we are at the final stage of testing the coated cloth for its anti-viral property, specifically for COVID-19. After up-scaling of this technology at IIT(ISM) Dhanbad, this coated cloth can be commercialized for public use.