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Study of contribution of ligand oleylamine in anti-SARS-CoV-2 activity of silver nanoparticles, a novel alternative for the Smart Surfaces development

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According to the World Health Organization (WHO), the virus SARS-CoV-2, the causative agent of COVID-19, has infected approximately 775 million individuals and resulted in over 7.0 million deaths[1] due to disease-related complications. Smart surfaces offer a promising and durable approach for virus inactivation and disease prevention[2]. Current literature typically focuses on the influence of nanomaterial composition, concentration and size on their efficacy against SARS-CoV-2[3]. This study quantitatively assesses the role of the nanoparticle surfactant in their anti-SARS-CoV-2 activity. Spherical silver nanoparticles (Ag@OAm) with an average diameter of 8 ± 2 nm were synthesized and characterized using Fourier-Transformed Infrared (FTIR), Dynamic Light Scattering (DLS) and Transmission Electron Microscopy (TEM) techniques. Oleylamine (OAm) was chosen as surfactant to increase their hydrophobicity. Both OAm and Ag@OAm were applied onto commercial surgical masks using drop-casting methods. Biological assays showed that the nanoparticles achieved 99.6(2)% virus inactivation rate within two minutes of exposure, while the free OAm ligand alone resulted in a 51(1)% inactivation rate. The antiviral activity of both OAm and Ag@OAm increased with the quantity of deposited material and exposure time, reaching up to 67(1)% and 100(1)%, respectively, for ten minutes. This study provides the first quantitative evidence of the significant role of the capping ligand of the nanoparticle in the deactivation of SARS-CoV-2, highlighting its critical importance in combating COVID-19. Moreover, it suggests that silver nanoparticles coated with oleylamine could be viable alternatives for the production of Personal Protective Equipment (PPE) and various solid matrices, including textiles.

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