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Academic Digest

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Academic Digest | July 2021

Welcome to the 7th edition of the Inivos Academic Digest for 2021, where our team share the most interesting and thought-provoking research across microbiology, personal protective equipment (PPE) and infection prevention and control.

Over July, and similarly to the previous month, research and efforts have been consistent on PPE decontamination and how technologies including HPV and UV-C can decontaminate PPE without having a significant impact on the integrity, appearance and function of the masks. Papers were published in the *American Journal of Infection Control, International Journal of Environmental Research and Public Health* and *PLOS One*. In addition, more work has been highlighted on the susceptibility of COVID-19 patients to acquire secondary infections as a result of hospital admission. Papers were published in Infection and the Journal of Infection.

The next challenge will be to further investigate the viability of SARS-CoV-2 in the environment and how the virus can survive on different environmental media. Papers were published in *Environmental Research and The Science of Total Environment.*

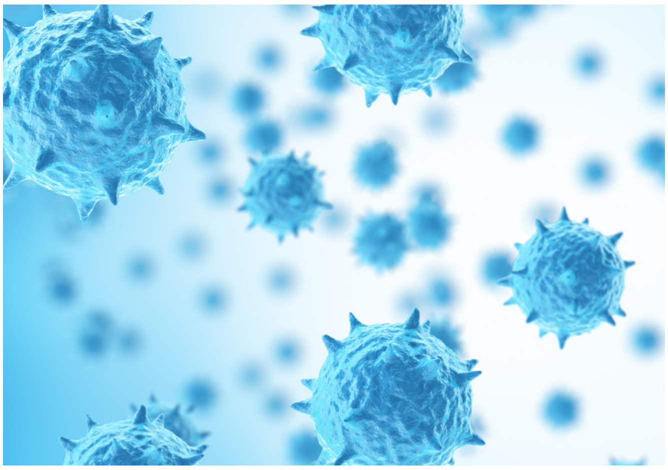
PPE DECONTAMINATION

One in-vitro study in the American Journal of Infection Control[1] investigated the efficacy of vaporised hydrogen peroxide decontamination (VHP) technology in decontaminating N95 respirators inoculated with SARS-CoV-2 or HCoV-299E, without affecting integrity and function of the masks. 42 masks were treated in a hospital processing facility and exposed to 3 cycles of VHP. No viable SARS-CoV-2 was detected after the treatment but only one mask (out of 21) had viable levels of HCoV-2EE. The researchers concluded that VHP is effective in inactivating SARS-CoV-2 on N95 masks without compromising filtration efficiency.

Another study in the American Journal of Infection Control[2] evaluated the effects of 6 decontamination cycles using VHP on N95 and PFF2 respirators. The researchers used scanning electron microscopy (SEM) and thermogravimetric analyses (TGA) to analyse the changes in morphology and structure that could significantly impact the efficiency of these masks. The findings indicated that after the 6 decontamination cycles, the fibre morphology in all layers was not affected, the thermal stability in the different layers was very similar and fit testing showed the fit of the respirators still intact after being exposed to these cycles. The authors concluded that VHP decontamination method is effective and does not significantly change the physical properties of the respirators.

Correspondingly, a study in the International Journal of Environmental Research and Public Health[3] developed an in-house testing method to investigate the efficiency of FFRs after being exposed to 10 cycles of VHP. It was found that the filtration efficiency (FE) of KN95 remained stable after 10 cycles (FE stability > 99.1%) for all particle sizes, while 3M-N95 masks were stable only at 2 and 5 μm (FE stability > 98.0%) and the FE at 0.3, 0.5, and 0.7 μm was significantly lower than 2 and 5 μm. The authors concluded that both masks showed high FE stability at 5 μm, which can be the size of the droplets associated with COVID-19 transmission. However, the KN95 mask showed higher FE stability than 3M-N95 masks at small particle sizes (0.3–2 μm) following 10 VHP cycles. Therefore, more research is needed to investigate the effects of more VHP decontamination cycles on PPE and more specifically on reusable PPE. Powered air purifying respirators (PAPR) which are reusable masks, are being tested against HPV decontamination technology to determine efficacy and material compatibility, and we look forward to sharing some results of studies by Test Labs in the near future.

One paper in PLOS One[4] evaluated the efficacy of UV-C light irradiation in decontaminating PPE placed inside a class III biosafety cabinet. N95 masks were inoculated with NL63 virus (a surrogate for SARS-CoV-2) and placed 61cm away from the light source. The researchers found that after using a UV dose of 60 mj/cm^{-2} for 5 minutes, log3 reduction was achieved and increasing the exposure time to 15 minutes caused complete inactivation of the surrogate.



COVID-19 AND SECONDARY INFECTIONS

A multi-centre international cohort study in the Journal of Infection[5] investigated the prevalence of secondary infections in cancer patients that tested positive for COVID-19. 684 patients were included (384 with solid tumours and 300 with haematological malignancies). Co-infections and superinfections were documented in 7.8% (54/684) and 19.1% (113/590) of patients, respectively. Lower respiratory tract infections were the most frequent infectious complications, most often caused by *Streptococcus pneumoniae* and *Pseudomonas aeruginosa*. Compared to patients without infectious complications, those with infections had worse outcomes, with high rates of acute respiratory distress syndrome, intensive care unit (ICU) admission, and mortality rates.

Another multicentre observational study in Infection[6] journal investigated the prevalence of secondary infections in critically ill patients with COVID-19 in eight ICU rooms. 248 patients were included of which 90 (36.3%) patients developed at least one episode of secondary infection. Overall ICU and hospital mortality were 33.9% and 42.9%, respectively. Patients developing bacteraemia had a higher risk of ICU mortality (45.9% vs. 31.6%) and hospital mortality [56.8% vs. 40.3%). It was concluded that the incidence of bacterial co-infections is high in critically ill patients infected with SARS-CoV-2.

VIABILITY OF SARS IN THE ENVIRONMENT

A study in Environmental Research[7] journal investigated the persistence of SARS-CoV-2 on frequently touched surfaces in different hospital wards, and also investigated the efficacy of ethanol and bleach at killing the virus. 76 samples were taken from different wards of the hospital, from which 40 tested positive for SARS-CoV-2. The samples were collected from high-touch surfaces such as patient bed handles, the nursing station, toilet door handles, cell phones, patient toilet sinks, toilet bowls, and patient's pillows. In addition, it was found that SARS-CoV-2 can remain viable on inanimate surfaces after disinfection by ethanol 70% and sodium hypochlorite (0.001 %). The researchers concluded that the findings from their study correspond to the time that the SARS-CoV-2 variant of concern (VOC) strain (lineage B.1.1.7) had emerged in their hospital and that this variant could possibly have different traits, characteristics, and stability which may make it persist longer in the environment.

A systematic review in the Science of Total Environment[8] explored the literature to analyse SARS-CoV-2 routes of transmission. They found that the main route of transmission is through airborne aerosols and droplets. This is because air samples with SARS-CoV-2 RNA have been detected in the air of different facilities such as healthcare settings, classrooms, banks, airports, train stations, offices, buses and other places. Also, SARS-CoV-2 can survive on solid surfaces from several hours to up to 7 days at room temperature and can survive longer at lower temperatures. SARS-CoV-2 was detected on bed rails, door handles, handrails, phones, computers, bank notes, protective masks, gloves and on many other objects and surfaces. In addition, researchers around the globe have reported SARS-CoV-2 RNA in wastewater or river water and reported that SARS-CoV-2 RNA was detectable in the stool of COVID-19 patients up to 30 days after illness onset.

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