

2021 AKCSE Seminar Series

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Time: 8:00 pm (EST)

Location: Zoom

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Infection Control Measures against Respiratory Pandemic/epidemic Diseases

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Abstract: Airborne transmission is critical to the spread of respiratory diseases. Currently used respiratory protection devices (e.g., surgical masks, N95 respirators) rely on filtration. In the absence of a system to inactivate pathogens on the filters, safety concerns arise on the risk of contact transmission. To this end, we propose a universal, reusable virus negation system, which efficiently deactivates viral/bacterial aerosols/droplets on a filter.

In this work, we report the development of a safe, highly effective pathogen deactivation system based on salt recrystallization. To demonstrate the concept, we coated polypropylene fibers of mask filters with three different types of natural salts (i.e., NaCl, K₂SO₄, KCl). Filtration efficiency and viral/bacterial inactivation were determined in vitro following exposure to influenza, bacteria, and coronavirus aerosols/droplets, and protective efficacy was studied in vivo. Virus destabilization was examined by measuring hemagglutinin activity and viral infectivity change. In parallel, broad-spectrum protection was evaluated by lethal infectivity of penetrated virus in vivo and infectivity of virus collected on filters during filtration in vitro.

Results showed that salt-coated filters have significantly superior filtration efficiency compared to conventional mask filters and guaranteed complete protection against viral infection. Virus on salt-coated filters showed rapid infectivity loss, demonstrating disruption of virus. Additionally, performance of salt-coated filters was not compromised by prolonged exposure to harsh environmental conditions. Therefore, our antimicrobial filters can guarantee development of reusable, universal respiratory protection devices for infection control during pandemics and epidemics.

Bio: Dr. Hyo-Jick Choi is an assistant professor in the Department of Chemical & Materials Engineering at the University of Alberta, and runs a sustainable engineering and drug delivery design (SEED) lab. Dr. Choi received his PhD in Biomedical Engineering from Univ. of Cincinnati (Sept. 2006-June. 2007)/ UCLA (Sept. 2002-Aug. 2006), followed by his postdoctoral fellowship at Georgia institute of Technology. Dr. Choi has made influential scientific contributions to bridging Engineering to Health Science by developing, 1) solid oral vaccine/biopharmaceuticals, 2) a minimally invasive transdermal drug delivery method using solid microneedles, and 3) universal and reusable personal protective measures. His capability in integrative fusion technologies and their commercialization enabled him to establish four start-up companies based on his research findings. Dr. Choi is an Editorial Board Member of Scientific Reports and topic editorial board member of Pharmaceutics. He was chosen as the Researcher of the Month for June 2017 by the Canadians for Health Research for his efforts in the development of virus deactivation system against pandemic/epidemic diseases and solid oral vaccines. E-mail hyojick@ualberta.ca

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