

Reduction of HAI by UV-C Disposable Gloves?

Hospital acquired infections (HAI) are one of the most pressing patient safety considerations. The Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) estimate that between 4-10% of all inpatients will develop an HAI - Why is it so hard to reduce HAI? Over the past 20 years, hand washing has been promoted by the CDC and WHO as the cure-all for HAI. Although world-wide health care facilities have generally adopted hand washing, the incidence of HAI has not been significantly reduced. What this means is hand washing itself is the most likely reason HAI is not reduced, even if done properly. In hectic hospital routines, hand hygiene is frequently neglected – the compliance rate is 30-60%. Moreover, hand washing is time consuming and HAI may reoccur anytime surfaces in the hospital are subsequently touched by health workers. Healthcare staff report they are too busy, or that repeated hand washing cause skin irritation and dryness, but also the belief that the use of gloves removes the need to wash the hands before patient contact.

Similar to the UV-C disinfection [1] of Ebola on surfaces and pathogens in drinking water from body heat using nano-coated bowls, QED induced EM radiation from NPs molded into disposable gloves is proposed to disinfect HAI. QED stands for quantum electrodynamics, EM stands for electromagnetic, and NPs for nanoparticles. Importantly, QED disinfection differs from microbial disinfection, the latter requiring contact of the HAI with the NP to allow chemical disinfection. In contrast, QED induces UV-C radiation from body heat in the fingers and may disinfect HAI at a distance, although the low intensity of UV-C limits the disinfection to nearby NPs.

QED conversion of body heat to UV-C finds basis in the quantum mechanics (QM) interpretation of the atom by the Planck law that precludes the atoms in NPs from having the heat capacity to conserve absorbed body heat by an increase in temperature. Instead, QED conserves body heat absorbed in NPs by frequency up-conversion to their TIR resonance. TIR stands for total internal reflection. See numerous QED applications at <http://www.nanoged.org/>, 2010 – 2015.

QED induced EM radiation is confined almost totally in the TIR mode of the NPs because of their high surface to volume ratio. Absorbed body heat therefore traps itself to the NP surface to form the temporary TIR confinement during which time QED converts the trapped EM energy to standing wave UV-C radiation across the NP diameter, the UV-C radiation having half-wavelength $\lambda = 2 n d$, where n and d are the refractive index and diameter and the NP. Since the standing UV-C radiation is created from the trapped energy in the surfaces, the TIR confinement vanishes and the UV-C radiation promptly escapes the NP to disinfect HAI. e.g., for ZnO having $n = 2.5$ and $d = 50$ nm, UV-C is created at $\lambda \approx 254$ nm.

References

[1] T. Prevenslik, "QED disinfection of Ebola and drinking water," 3rd International Conference on Prevention & Infection Control, June 16-19, 2015, Geneva