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Sterilization of Surfaces with a Handheld Atmospheric Pressure Plasma ROBERT HICKS, SARA HABIB, WAI CHAN, ELEAZAR GONZALEZ, UCLA, A. TIJERINA, MARK SLOAN, CMI — Low temperature, atmospheric pressure plasmas have shown great promise for decontaminating the surfaces of materials and equipment. In this study, an atmospheric pressure, oxygen and argon plasma was investigated for the destruction of viruses, bacteria, and spores. The plasma was operated at an argon flow rate of 30 L/min, an oxygen flow rate of 20 mL/min, a power density of 101.0 W/cm^3 (beam area = 5.1 cm^2), and at a distance from the surface of 7.1 mm. An average 6log$_{10}$ reduction of viable spores was obtained after only 45 seconds of exposure to the reactive gas. By contrast, it takes more than 35 minutes at 121°C to sterilize anthrax in an autoclave. The plasma properties were investigated by numerical modeling and chemical titration with nitric oxide. The numerical model included a detailed reaction mechanism for the discharge as well as for the afterglow. It was predicted that at a delivered power density of 29.3 W/cm^3, 30 L/min argon, and 0.01 volume% O_2, the plasma generated 1.9 x 10^{14} cm^{-3} O atoms, 1.6 x 10^{12} cm^{-3} ozone, 9.3 x 10^{13} cm^{-3} $O_2(^1\Delta_g)$, and 2.9 x 10^{12} cm^{-3} $O_2(^1\Sigma_g^+)$ at 1 cm downstream of the source. The O atom density measured by chemical titration with NO was 6.0 x 10^{14} cm^{-3} at the same conditions. It is believe that the oxygen atoms and the $O_2(^1\Delta_g)$ metastables were responsible for killing the anthrax and other microorganisms.

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