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Long Term Effects of Multiple DBD Pulses on Thin Liquid Layers Over Tissue: Reactive Fluences and Electric Fields[1] WEI TIAN, MARK J. KUSHNER, University of Michigan — Atmospheric dielectric barrier discharges (DBDs) are used in treatment of tissue, often covered by thin liquid layers. The reactivity reaching the tissue depends on the plasma dose, composition and acidification of the liquid, and the cumulative delivery of electric fields through the liquid. In this paper, we report on a computational investigation of the interaction of DBDs with a thin liquid layer covering tissue over many minutes. We used *nonPDPSIM,* a 2-d model in which Poisson's equation, the electron temperature equation, transport equations for charged and neutral species and radiation transport are solved in both the gas and liquid. The liquid layer, 100's μm thick, is water with dissolved gases [O_{2aq} (aq is aqueous), CO_{2aq}], metal ions (Fe^{2+}_{aq}, Fe^{3+}_{aq}), and organics (RH_{aq}). Hundreds of pulses at 100 Hz are computed, followed by minutes of afterglow. In the liquid, transient radicals (OH_{aq}, H_{aq}) are produced during the discharge pulse and are consumed during the interpulse period. Terminal species (H_2O_{2aq}, O_{3aq}) accumulate and diffuse to the tissue. Ions are dominated by NO_{3^-aq}, O_{2^-aq} and $H_3O^+_{aq}$. Production of HNO_{3aq} and $HOONO_{aq}$ is assisted by O_{2aq} for the first pulses and then O_{3aq}. Accumulating nitric acid lowers the pH. RH_{aq} consumes most reactive oxygen species in the early plasma treatment leaving $R\bullet_{aq}$. With longer exposure, RH_{aq} can be consumed, enabling more ROS to reach the tissue. The cumulative exposure of electric fields to the tissue depends on the increasing conductivity of the liquid.

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