Abstract Submitted
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Multi-pulse operation of an atmospheric-pressure plasma jet onto a reactive liquid layer.[1] SETH A. NORBERG, US Military Academy, GUY PARSEY, STUART DAUDLIN, AMANDA M. LIETZ, ERIC JOHNSEN, MARK J. KUSHNER, University of Michigan — Medical applications of non-thermal atmospheric plasmas are predominantly associated with modification of a liquid environment surrounding tissue. The plasma-induced biological response results from reactive oxygen and nitrogen species (RONS), either produced in the liquid-phase or transferred through solvation from the gas-phase, reaching the target tissue. In atmospheric pressure plasma jets (APPJs), the pulse repetition frequency (PRF) and proximity of the ionization wave to the liquid surface, controlled indirectly through pulse duration, stand out as parameters that can be adjusted to achieve the desired outcome. An APPJ incident onto tissue with an intervening reactive liquid layer was simulated using a 2-dimenstional plasma hydrodynamics model while varying the PRF and plasma-liquid proximity. A high PRF allows for plasma activated species to co-exist in the gas phase for multiple pulses resulting in increasing densities of N_xO_y and hence aqueous NO_3^- and $ONOO^-$. Conversely, a lower PRF minimizes inter-pulse reactions in the gas phase which consume ROS, resulting in a higher ROS fluence to the underlying tissue. The altered reaction pathways are not linear with the PRF as aqueous H_2O_2 fluences to the tissue are not sensitive to PRF variation. Significantly different ratios of fluences of reactive species to the tissue occur when comparing touching and non-touching interaction of the plasma-plume and liquid surface.

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