

GEC15-2015-000035

Abstract for an Invited Paper
for the GEC15 Meeting of
the American Physical Society

Measurement of reactive species for plasma medicine

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Plasma medicine has been intensively studied over the last decade. Reactive oxygen and nitrogen species are responsible for the therapeutic effects in plasma medicine. To examine the therapeutic effects of reactive species, the densities of OH, O, and NO were measured using laser-induced fluorescence (LIF). A helium atmospheric-pressure plasma jet (10 kV, 10 kHz of 40 μ s pulses) and a nanosecond streamer discharge (24 kV, 8 ns, 30 Hz) were utilized to treat mouse melanoma cells in a culture medium. Correlation between the dose of reactive species and deactivation rate of melanoma cells was measured with the aid of LIF. The results showed that the rate of cell death correlates with OH density, but not with O and NO densities. Next, a method to supply a specific reactive species to living organisms was developed. It utilizes photolysis of helium-buffered H₂O and O₂ by vacuum ultraviolet (VUV) light to produce reactive species. The VUV method was utilized to sterilize *Bacillus atrophaeus* on agar plate. With the VUV method, it was succeeded to show sterilization only by OH radicals. A 30 s treatment with approximately 0.1 ppm OH radicals caused visible sterilization.