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Atmospheric pressure dry- and mist-plasma jets using pulsed power generator and their effects on HeLa cells

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Atmospheric-pressure plasma jets have recently received significant attention due to its unique capabilities as low temperature, low cost, portability, and ease of operation which are suitable to such novel applications as analytical chemistry, thin film processing, nanomaterial synthesis, surface modification, sterilization, and etching. In biological applications, chemical species including NO2, HNO3, O3 and OH generated in air phase are rapidly dissolved and transported into liquid phase, and accompanied chemical stimuli can inactivate bacteria. The hydroxyl radical (OH) in particular plays an important role in plasma chemistry and plasma medicine due to its oxidation and disinfection potential, substantially higher than other oxidative species. Also reported is that H2O2 produced by plasma holds potential for inactivation of HeLa (human cancer) cell viability. In our previous study focusing on OH and H2O2 production, we developed a "mist plasma jet (MPJ)" generated using dry helium gas mixed with water mist to improve upon the traditional method using only dry helium gas, known as the "dry plasma jet (DPJ)". This study focuses on observation and comparison of effects of both MPJ and DPJ on HeLa cells surrounded by cell culture medium immediately after irradiation by plasma and following 24 hours. First, we examined voltage dependency of saturation temperatures on DPJ and MPJ; next, we irradiated plasma to cell culture medium including cells and observed cells exposed to the plasma-treated culture medium after 24 hours. These experiments revealed that MPJ more greatly influences cell death than DPJ.

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