Generation and Characterization of Cold Atmospheric Pressure Plasma Jet and Its Applications

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Cold atmospheric pressure plasma jet (CAPPJ) has many applications in biomedicine and polymer surface modification to enhance adhesion properties. Using argon as a carrier gas, the gas temperature, remains at room temperature even after hours of operations. The plasma jet can be touched by hands and directed manually by a user to bring in contact with heat-sensitive objects and materials including skin without causing any heating or painful sensation. CAPPJ has been generated by a high voltage power supply (0-20 kV) at an operating frequency of 25 kHz. The discharge has been characterized by electrical and optical methods. In order to characterize the plasma jet, its electron temperature and electron density have been determined by optical emissions spectroscopy. This paper reported the antimicrobial and anticancer property of cold atmospheric pressure plasma.

The result indicates that CAPPJ is capable of killing the microbial population in its exposed area. Plasma jet was used to treat selected strains of pathogenic bacteria for varying voltage (4-6 kV and 25 kHz) and varying time duration.

Cold plasma used to treat normal and cancer cell lines (at working voltage 13 kV and line frequency 50 Hz) to show strong anticancer property of plasma. The reactive species present in the cold plasma jet: high-energy electrons, ionized atoms and molecules, and UV photons are the key factors that cause an effective reduction in the number of microorganisms and killed cancer cells as well with compared to control cells. The cold plasma treatment selectively killed cancer cells without affecting normal cells in vitro. It has been observed that the percentage viability of the cell lines varies with the plasma treatment time along the best fitted curve of a power function.

The curve is steeper for the cancer cells than for the normal cells after plasma treatment. The faster decaying curve signifies the selective killing of the cancer cells compared to the normal cells within the exposure time. This study indicates that the reactive oxygen species in the CAPP activate the apoptosis pathway in the cancer cells

Key words:
Cold atmospheric pressure plasma jet, Antibacterial property, Anticancer property of plasma, Efficacy, Reactive oxygen and nitrogen (RON) species

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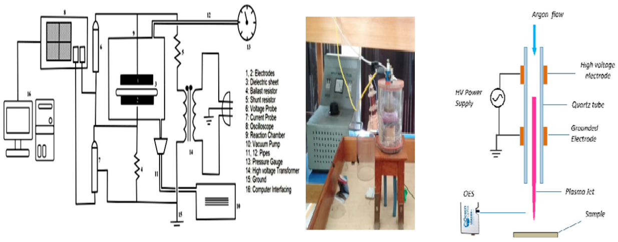
Figure xx



(a) (b)

Experimental Setup