A Systematic Comparison of the Characteristics of Helium and Argon Atmospheric-Pressure Plasma Jets for Biological Applications

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ABSTRACT

Introduction: In this study, we present a novel 90 cm-long atmospheric pressure plasma jet transfer (APPJt) system specifically developed for biomedical applications.

Materials and Methods: The APPJt was powered by 23 kHz AC excitation, utilizing helium and argon as working genes.

Results and Discussion: Optical Emission Spectroscopy confirmed the generation of key reactive oxygen and nitrogen species. The plasma jet transfer maintained an almost uniform temperature along the 90 cm transfer path and at the jet tip. Comparative antibacterial assays against dominant pathogens suggested that argon gas exhibits significantly greater bactericidal activity than helium, which aligns with its higher generation of reactive oxygen and nitrogen species, as evidenced by its emission spectra.

Conclusion: Our findings show that the developed plasma jet transfer system, with its low operating temperature and minimal power consumption, is well-suited for biomedical use. Its ability to deliver cold plasma through flexible tubing without compromising performance opens opportunities for safe applications in wound care, sterilization, and minimally invasive therapies without the risk of thermal damage to surrounding tissues.

Keywords: Cold plasma, Medical application, Plasma Jet transfer, Reactive oxygen-nitrogen species

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