Research Highlights

10 मि.मी. की दूरी पर गैर-संपर्क जीवाणु निष्क्रियता की जांच

प्लाज़्मा औषधी के लिए एक स्वदेशी शीत प्लाज़्मा उपकरण का उपयोग करके

Investigation of Non-Contact Bacterial Inactivation at 10 mm Distance

Using an Indigenous Cold Plasma Device for Plasma Medicine

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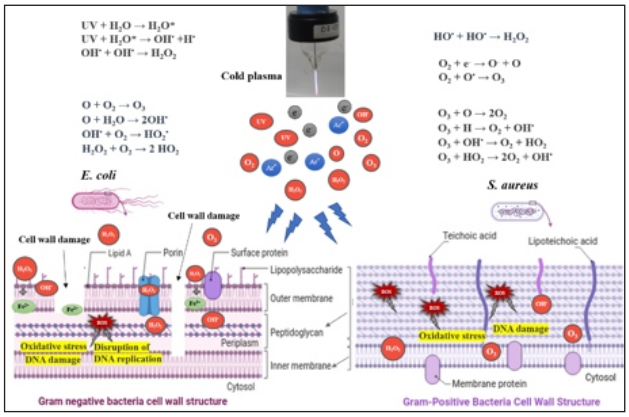
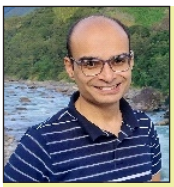
Cold atmospheric pressure plasma (CAPP) is a promising antimicrobial technology, though its bactericidal mechanisms are not yet fully understood. An indigenous Tesla coil–based CAPP device was developed from first principles and evaluated against Gram-positive Staphylococcus aureus (S. aureus) and Gram-negative Escherichia coli (E. coli) using Ar, Ar–O , Ar–N , and Ar–dry air (3:1) gas compositions at a 10 mm treatment distance. Optical emission spectroscopy identified key bactericidal species including OH (~309 nm), N SPS (~337 nm), and OI (~777.4 nm), while electron microscopy confirmed plasma-induced cellular damage. Spectroscopic analysis quantified H O , OH radicals, UV radiation, and O . This work is recently published results (Vacuum 239 (2025) 114393) showed that pure Ar plasma, possessing the highest electron temperature and density, generated maximum H O and UV radiation, achieving complete inactivation of both bacterial strains at 10 mm distance. The study further revealed greater resistance of E. coli due to its protective outer membrane, while H O was found to play a crucial role in bacterial inactivation through oxidative stress and intracellular OH generation via the Fenton reaction. Efficient non-contact sterilization at 10 mm highlights its strong potential for remote sterilization and biomedical applications, enabling treatment without thermal or electrical discomfort while offering significant advantages for maintaining sterile environments in healthcare and industry.



About the author...



Dr. Rajib Kar is a Scientific Officer-G at the Laser & Plasma Technology Division, Bhabha Atomic Research Centre (BARC). His research focuses on non-thermal plasma applications, diagnostics, and development of novel atmospheric pressure plasma systems. His areas of interest include plasma medicine, plasma synthesis of carbon nanostructures, cold plasma-based decontamination, and plasma diagnostics using electrical probes and spectroscopy. He has published 93 research papers in reputed international journals and conferences, contributed book chapters for Elsevier, Springer, and BARC-SIRD publications, and serves as a reviewer for several international journals. His work has also led to technology transfer of a Cold Plasma Sterilization Device and the Indigenous Cold Atmospheric Pressure Plasma System: 10 MHz (ICAPPS-10) for scientific and industrial applications.