

Dielectric barrier discharged cold atmospheric plasma for the inactivation of multi drug resistance microbes

Cold atmospheric plasma (CAP) is generally a nonthermal plasma having plasma gas temperature around room temperature. Presence of reactive oxygen and nitrogen species (RONS) in CAP along with the charge particles makes the CAP a therapeutically important agent. Application of cold plasma in the field of biomedicine is recently becomes a cutting-edge research field since last two decades. CAP have been successfully applied for inactivation of various multidrug resistance microbes. CAP has been successfully applied for chronic wound healing. Research is going on to apply CAP in the field of oncology by various groups. Various discharge configurations have been used for the production of CAP suitable for biomedical application. Dielectric barrier discharge is one of them. At Institute of Advanced Study in Science and Technology (IASST), Guwahati a dielectric barrier discharged cold atmospheric plasma set up has been developed in house in aim to its application in medical field. It consists of a cylindrical shape brass electrode of diameter 10 mm with hemispherical tip. The electrode is covered with 1-mm thick quartz glass. A stainless steel mesh is used as a grounded electrode. A quasi sinusoidal high voltage pulse ($V_{PP} \sim 20 - 30kV$) of pulse repetitive frequency $\sim 20 - 30$ kHz from a in-house made power supply has been applied between the electrodes to obtain the CAP. Electrical characterization of the device has already been performed [1]. The CAP produced from the setup has been successfully utilized to inactivate microorganisms, namely multi-drug resistant *Escherichia coli* (ATCC BAA-2469), *Staphylococcus aureus* (MTCC 96), and *Candida albicans* (MTCC 227) and compare the efficacy with tested antibiotics [2]. Notably, just 20s CAP treatment has surpassed the zone of inhibition (ZOI) of 10-50mcg tested antibiotics. The study shows its novelty in uniquely delaying the growth of microorganisms after CAP treatment. Detailed results will be presented.

References :

- [1] R. B. Gohain and S. Biswas, "Impact of applied voltage, air gap, and ground arrangement on discharge power and dielectric capacitance in a volume DBD plasma", *Physica Scripta* 100, 025604 (2025).
- [2] P. Talukdar, R. B. Gohain, P. Bharadwaj, D. Thakur and S. Biswas, "Inactivation of *Candida albicans*, *Staphylococcus aureus*, and multi-drug resistant *Escherichia coli* with dielectric barrier discharged cold atmospheric plasma: A comparative study with antimicrobial drugs", *Journal of Medical Microbiology* 74, 001965 (2025).

Author: Dr BISWAS, Subir (Institute of Advanced Study in Science and Technology, Guwahati 781035, Assam, India)

Presenter: Dr BISWAS, Subir (Institute of Advanced Study in Science and Technology, Guwahati 781035, Assam, India)