

Seminar

Institute for Plasma Research

Title : Impact of Plasma on Bacterial Inactivation: Studies on Probable Biochemical Actions and Mechanisms
Speaker: Dr. Tejal Barkhade
Institute for Plasma Research, Gandhinagar
Date : 12th October 2023 (Wednesday)
Time : 03.30 PM
Venue: Seminar Hall, IPR
Join the Talk: <https://meet.google.com/cop-cuph-wgj>

Abstract: Plasma sterilization has gained significant attention from researchers in recent years due to its potential as an effective method for killing microorganisms. Indeed, plasma sterilization has emerged as an alternative to conventional sterilization methods for several reasons. Although, the underlying mechanisms and biochemical actions involved in the plasma treatment are still not fully understood. Plasma is a complex and dynamic medium, and its interaction with biological materials, such as microorganisms, is a subject of ongoing research. In present work, we investigate the inactivation of the micro-organisms *Staphylococcus aureus* (SA) and *Pseudomonas aeruginosa* (PA) by microwave (MW) plasma. The inactivation is first measured using bacterial immobilized catheters in terms of the reduction in colony forming units (6-Log-CFU/mL). After 10 min of plasma exposure, zero colonies of SA and PA were found on nutrient agar media plates respectively. Spectrofluorometric technique were then employed for in-depth understanding of bacterial inactivation. The generation of reactive oxygen species (ROS) on the bacterial membrane and variation in membrane potential due to plasma exposure were studied using fluorescent probes. It was found that the amount of $\cdot\text{OH}$ and H_2O_2 radicals increased after increase in the plasma exposure time, which resulted into oxidative stress in bacteria. On the other hand, the DNA concentration of SA and PA was decreased after plasma treatment analyzed using UV-Visible Spectrophotometer. Further, FE-SEM micrographs reveals the deformation of cell morphology and cell aggregation after MW plasma exposure. The above outcomes of investigation in plasma sterilization not only improve the sterilization process itself but also contribute to a broader understanding of antimicrobial inactivation strategies. Subsequently, the knowledge gained from plasma research can be extrapolated and applied to other methods, potentially leading to more effective and targeted approaches for combating microbial contamination and infection problem in healthcare system.

Keywords: Sterilization, Microwave (MW) plasma, Bacteria, Reactive oxygen species (ROS), *Staphylococcus aureus* and *Pseudomonas aeruginosa* (PA)