Seminar

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Institute for Plasma Research

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Title:	Investigation of Atmospheric Pressure Dielectric Barrier Discharge Plasma for Synthesis of Nitrogen based Fertilizer in Water
Speaker:	Dr. Navin Kumar Sharma Institute for Plasma Research, Gandhinagar
Date:	30th October 2025 (Thursday)
Time:	11.00 AM
Venue:	Seminar Hall, IPR

Abstract

This study investigates the synthesis of urea in water using an atmospheric pressure plasma source operated with a N_2–CO_2 gas mixture. It aims to develop an eco-friendly method alternative to conventional urea production by enabling nitrogen–carbon fixation under ambient conditions. The atmospheric pressure plasma discharge produces reactive species such as excited N_2, N, NOx, CO, and CO_2^+ that dissolve and participate in aqueous reactions, ultimately forming urea and other nitrogen–carbon compounds.

In the present work, characterization of Co-axial Dielectric barrier discharge reactor has been carried out which has been employed to treat deionized water for different interval of time under varying input powers and gas compositions (N_2:CO_2). To gain comprehensive insight into the discharge behavior, electrical diagnostics has been performed to determine the power deposition characteristics, and optical emission spectroscopy is employed to identify the active species formed in the plasma. Furthermore, the treated water was tested using the diacetyl monoxime (DAM) colorimetric method, showed the urea formation in the water. Slightly decrease in pH and increase in ORP was observed after plasma treatment, indicating enhanced acidification and confirming active plasma-induced chemical reactions in the water.

In addition to this work, design and development of microwave plasma reactor for water treatment has been carried out aimed at enhancing urea production efficiency through higher plasma energy density and improved gas–liquid interaction.