

Seminar

Institute for Plasma Research

- Title:** Plasma Activation of Water and Medium and their Study
- Speaker:** Mr. Vikas Rathore
Institute for Plasma Research, Gandhinagar
- Date:** 05th August 2022 (Friday)
- Time:** 02:00 PM
- Venue:** Join the talk online
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Abstract

Plasma-activated water (PAW) is known for its numerous applications for example inactivation of pathogens (bacteria, fungi, viruses, pests, etc.), food preservation, seed germination, plant growth, etc. These applications of PAW are possible due to various reactive oxygen-nitrogen species (RONS) (NO_3^- ions, NO_2^- ions, H_2O_2 , dissolved O_3 , etc.) present in it.

In the present work, the design and development of a plasma device to produce plasma-activated water have been discussed. Moreover, the effect of process parameters on physicochemical properties and RONS concentration of PAW is also studied. The obtained results showed that the plasma-water interaction time and plasma discharge power play a significant role in controlling the physicochemical properties and RONS concentration of PAW [1,2]. At optimum parameters, the bactericidal and fungicidal efficacy of PAW and its mechanism have been conducted. The results reveal that PAW can kill a high concentration of bacterial and fungi colonies and retains this efficacy for the long term [3,4]. PAW also has the potential to improve the germination of seeds and plant growth. The study on pea (*Pisum sativum*) seeds germination and plant growth using PAW shows it significantly improves the germination rate of seeds. This is due to PAW treatment with seeds removing the hydrophobic wax structure naturally occurring on the seeds surface and making the surface more hydrophilic. Hence, PAW grown plant showed a higher length compared to the control [5].

In conclusion, PAW has the potential to be used as a chemical-free alternative for various disinfection purposes (bacteria, fungi, viruses, pests, etc.). Also, it has the enormous potential to be used in the medicine, agriculture, and food sector.

References:

1. Rathore, V. & Nema, S.K., "Optimization of process parameters to generate plasma activated water and study of physicochemical properties of plasma activated solutions at optimum condition", *J. Appl. Phys.* 129, 084901 (2021) <https://doi.org/10.1063/5.0033848>
 2. Rathore, V., Patil, C., Sangharyat, A. et al. Design and development of dielectric barrier discharge setup to form plasma-activated water and optimization of process parameters. *Eur. Phys. J. D* 76, 77 (2022). <https://doi.org/10.1140/epjd/s10053-022-00397-4>
 3. Rathore, V., Patel, D., Butani, S. et al. Investigation of Physicochemical Properties of Plasma Activated Water and its Bactericidal Efficacy. *Plasma Chem Plasma Process* 41, 871–902 (2021). <https://doi.org/10.1007/s11090-021-10161-y>
 4. Rathore, V., Patel, D., Shah, N. et al. Inactivation of *Candida albicans* and Lemon (*Citrus limon*) Spoilage Fungi Using Plasma Activated Water. *Plasma Chem Plasma Process* 41, 1397–1414 (2021). <https://doi.org/10.1007/s11090-021-10186-3>
 5. Rathore, V., Tiwari, B.S. & Nema, S.K. Treatment of Pea Seeds with Plasma Activated Water to Enhance Germination, Plant Growth, and Plant Composition. *Plasma Chem Plasma Process* (2021). <https://doi.org/10.1007/s11090-021-10211-5>
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