Non-equilibrium Cold Plasma Technologies for Health and Environmental Applications

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Recent years have seen a wide range of cutting edge uses for non-equilibrium cold plasmas and related pulse power technologies in the fields of biology, medicine, food, agriculture, and the environment [1]. Such plasmas are capable of effectively eliminating spores and biofilms (which are typically very difficult to inactivate), as well as bacteria, yeasts, molds, and other hazardous microbes, including possible bioterrorism agents [2]. The capacity to attain improved gas phase chemistry without the requirement for high gas temperatures is the most alluring aspect of these plasmas. Such plasmas exhibit electron energies much higher than that of the ions and the neutral species that remain near room temperature and the energetic electrons enter into the collision with the background gas, causing the enhanced level of dissociation, excitation, ionization, etc. Due to this fact, plasma does not cause any thermal damage to the objects it comes into contact with, and hence it is easy to use such plasmas for growing plants, preserving the quality, safety, and sustainability of food, as well as for bio-decontamination and sterilization of surfaces, water, air, food, and even living tissues without compromising them or having other negative effects. As a result, such cold plasmas have enormous potential for the food, agriculture, health and environment sectors. Several synergistic mechanisms, including as UV radiations, electric fields, charged particles, produced radicals, and reactive species, can be attributed to such plasma treatments. Global efforts are being made to create newer technologies and comprehend the physical, chemical, and biological elements of cold plasma for use in health and environmental application.

At IIT Jodhpur, a number of Dielectric Barrier Discharge based Cold plasma systems are being developed including Cold Plasma Jets, Plasma Activated Water, Surface DBDs, far UV-C (KrCl*) and UV-C (XeI*) excilamps and the same are effectively utilized for the health and environmental applications [3-6]. Efforts made in utilizing such cold plasma systems for effective degradation of micro-pollutant in water will be presented.

References

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