

# Plasma generation using Plasma Gun above or inside liquid solutions

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Low temperature plasma treated solutions are under intense study with respect to their key importance for plasma biomedical, plasma environmental and plasma agriculture technologies applications [1,2]. In this work, we report on the use of various plasma jet based delivery protocols likely to generate reactive species enriched solutions for such applications. The baseline setup consists in the use of the Plasma Gun (PG) device [3] delivering a so called plasma plume a few mm away from the liquid to be treated. Such single jet configuration is easily turned into a multi jets setup [4], using a branching capillary assembly, while keeping the same power supply operated with the same voltage amplitude and microsecond pulse repetition rate together with the same range of buffer gas flow rates flushed inside the primary capillary plasma generation reactor. As a second kind of protocol, we report on the liquid solution treatment when plasma reactor capillary is immersed inside liquid solutions, thus resulting in the generation of plasma inside buffer gas bubbles. Reactive species generation in liquid solutions is reported using either plasma plumes or in-bubble plasmas based on the Plasma Gun devices. In-bubble plasma generation with triggering of plasma ignition at different stages of the bubble dynamics, offers opportunities for reactive species balance modulation. Our experiments show that plasma can be delivered in small volume bubbles which then allow for efficient diffusion in the bulk liquid solution, thus opening opportunities for efficient high repetition rate multi bubbles plasma delivery.

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## **References**

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