Activation and bio-decontamination of water by cold atmospheric plasma, towards green fertilizer with lower environmental impact

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The reactive chemical species generated by cold atmospheric plasma of electrical discharges can be trapped in liquids, particularly water, to produce a chemically rich solution called plasma-activated water (PAW) [1]. PAW has demonstrated strong antimicrobial properties and has been extensively studied for its wide range of applications in food preservation, agriculture, and biomedicine and has a great potential for wastewater treatment, especially to inactivate toxic microorganisms [2]. So far the studies applying plama discharges and PAW against cyanobacteria are rare [3].
By combining two distinct plasma sources - a transient spark, generating nitrogen oxides and nitrous/nitric acids, and an ozone generator based on dielectric barrier discharge - we were able to generate two distinct types of PAW. The first type, rich in NO_2^- (nitrite ions), exhibits strong antimicrobial properties and is suitable for the bio-decontamination of water. The biocidal effects of this PAW, generated by the transient spark, were verified on several microorganisms [4, 5]. Further research, including tests on cyanobacteria, is planned to assess its efficacy against a wider range of microbial contaminants. The second type of PAW, rich in $NO3^-$ (nitrate ions), shows promise as an alternative fertilizer for plants, presumably with a lower potential for causing harmful cyanobacteria blooms compared to traditional nitrogen-based fertilizers.

Keywords: nitrogen fixation, green agriculture, water bio-decontamination, cold plasma

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