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Plasma-Generated Nitric Oxide Water for Biological Applications: Infection Control and Cosmetic Innovations

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Cold atmospheric plasma (CAP) offers a transformative platform for next generation wound care. Direct CAP modalities—such as high frequency plasma jets—deliver a cocktail of short-lived reactive oxygen and nitrogen species (RONS), UV photons, and pulsed electric fields to eradicate pathogens and stimulate tissue repair. Our primary focus, however, lies in indirect CAP applications via plasma activated water (PAW), particularly nitric oxide enriched solutions (NOW), emerging as more scalable, portable, and patient-friendly strategy for widespread clinical and commercial translation. We have pioneered two core NO generation systems: a 2.45 GHz microwave plasma generator (MPG) capable of producing 10–100 ppm NO in bulk water, and a portable cylindrical dielectric barrier discharge (C-DBD) device optimized for selective NO synthesis from ambient air.

This talk explores plasma-generated nitric oxide (NO) water for decontamination, microbial inactivation, and viral sterilization, aligning with Plasma Life Science. Our research advances eco-friendly plasma-based nanomaterial synthesis and sustainable pathogen control in agriculture, healthcare, and cosmetics. With applications in green nanotechnology and biomedical sciences, plasma-driven innovations offer cost-effective, sustainable solutions for industry and life science applications.

This work highlights the potential of plasma-generated nitric oxide (NO) water by MPG and C-DBD system for microbial inactivation, viral sterilization, skin treatment and environmental applications. Our research explores its role in sustainable agriculture, eco-friendly nanomaterial synthesis, and biomedical innovations. Additionally, plasma-generated NO water shows promise in cosmetic applications, including anti-aging treatments. These cost-effective and environmentally responsible methodologies offer transformative solutions in skin care bioscience, and healthcare.

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