# Multi-Wavelength UV LEDs for Safe Water

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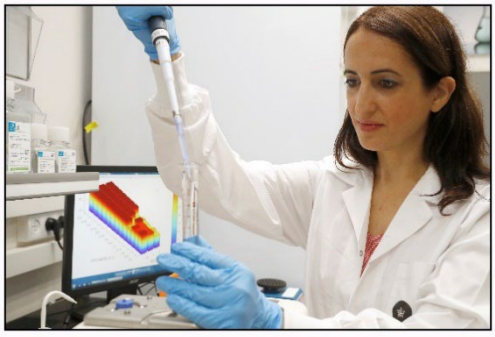
Abstract

This research explores the efficacy of using simultaneous UV LED wavelengths in a flow-through reactor to inactivate *E. coli* in tap water. The study, operating at a flow rate of 1 LPM, deviates from traditional single-wavelength UV sanitation by adopting a multi-wavelength methodology. Results showed that simultaneous exposure to mixed LED wavelengths (notably LED280/300) resulted in a significantly higher inactivation rate compared to the theoretical aggregate of individual LED wavelengths. This approach demonstrated between 90-99% improvement (1.7-log synergy) in *E. coli* inactivation, far exceeding the under-1-log inactivation observed with the summation of single 280 nm or 300 nm LEDs. The combined LED280/300 technique achieved close to 99.9% disinfection efficiency. These results underscore the superior effectiveness of using mixed UV LED wavelengths in water disinfection processes. The observed synergy is likely due to the activation of multiple deactivation pathways, including both nucleic acid damage and protein-based mechanisms, offering an innovative approach to microbial deactivation beyond single-pathway reliance. The integration of these mechanisms underlines the potential of multiwavelength strategies in achieving enhanced disinfection results. The study extends to a pilot project in Uganda, in collaboration with an NGO, showcasing the application of UV LED technology for safe water in low-income settings.

Short Biography



Professor Hadas Mamane is head of the Environmental Engineering Program and the Water-Energy (WE) Lab at the School of Mechanical Engineering, Tel Aviv University, Israel. She received her Ph.D. from Duke University, USA. Her research focuses on the disinfection and oxidation of contaminated water, and wastewater, and the conversion of waste to valuable products, by integrating solar light, UV light-emitting diodes (LED), ozone, photo-catalysis, and nanomaterials. She is passionate about developing decentralized, effective, scalable, point-of-use (POU) systems suitable for providing safe water in rural areas and low-income settings and for the treatment of sewage ponds. Prof Mamane was appointed as an adjunct faculty at IIT Madras, India.