Pulsed UV Light system demonstrates a faster and safer way to decontaminate water

Overview

In this study, Pennsylvania State University researchers explored the effectiveness of Pulsed UV Light treatment as a method for disinfecting water. They focused on Bacillus subtilis spores, a microorganism commonly found in water that pose a risk to human health if not eliminated.

Results showed a Pulsed UV Light flow-through system successfully eliminated the spores without any subsequent growth observed. These findings suggest that Pulsed UV Light has great potential as an effective method for water disinfection. The researchers also highlighted the need for further investigation, including testing at higher flow rates to optimize the system, and emphasized pulsed light's ability to inactivate pathogens with less energy and in a shorter period compared to other methods.

Markets/Applications

- Drinking water: Ensure the removal of harmful pathogens and provide safe drinking water to communities.
- Wastewater: Eiminate pathogens and reduce the risk of contamination when treated water is released back into the environment.
- Food & beverage: Disinfect water used in food processing, beverage production, and equipment cleaning.
- Healthcare facilities: Reduce the risk of infections and promote patient safety by disenfecting water used for handwashing, equipment cleaning, and other uses

Highlights

- Pulsed UV light proved effective in inactivating Bacillus subtilis spores
- Pulsed UV light has the potential for inactivating other pathogens of concern like Cryptosporidium parvum protozoa.
- Compared to continuous UV light treatment, Pulsed UV Light demonstrated superior energy efficiency while achieving more pathogen inactivation in less time.
- The ability of Pulsed Light to reduce the turbidity of water indicates its potential to disintegrate organic material through oxidation, further enhancing its effectiveness in water disinfection.
- The findings emphasize the potential of Pulsed UV Light as a sustainable alternative for water disinfection, as it offers a highly efficient and effective approach to inactivate pathogens while minimizing the use of chemicals.

"Pulsed UV Light was found to disintegrate organic material in addition to disinfecting water."

The information in this report was prepared by XENON and does not contain the complete research conducted by *Demirci* et al. A full version of the research paper is available at https://pure.psu.edu/en/publications/disinfection-of-water-by-flow-through-a-pulsed-uv-light-steriliza

Summary of Research

Disinfection of water by flow-through Pulsed UV Light sterilization system

Original research by Ali Demirci, Ph.D., and Kathiravan Krishnamurthy (Pennsylvania State University)

Objective: Investigate the effectiveness of a flow-through Pulsed UV Light system to inactivate bacterial spores in water.

Methodology: Researchers conducted spore harvesting using different methods and compared the spore concentration obtained from agar plates and broth cultures. They also varied the incubation and assessed the role of wash solutions in achieving higher spore concentrations. Based on the findings, the method yielding the highest spore concentration was selected for further experimentation.

A XENON Corporation Pulsed UV Light system was used for treatment. Flow rates were tested ranging from 2 to 14 L/min. The initial inoculum concentration for each flow rate was determined, and the complete inactivation of Bacillus subtilis spores was achieved at all flow rates. No growth was observed after enrichment in both dark and light conditions, indicating the absence of injured cells and no recovery of spores through photo repair mechanisms.

Following Pulsed UV Light treatment, researchers examined the reduction in UV light absorption at 254 nm, indicating a decrease in water turbidity. This suggested that the treatment not only disinfects the water but also has the potential to disintegrate organic material through oxidation. The study also reported the energy per pulse, power, and estimated power at 254 nm for each tested flow rate, providing valuable insights into the energy absorption and temperature changes induced by the Pulsed UV Light treatment.

Results and Conclusions: Flow-through Pulsed UV Light treatment was highly effective in inactivating Bacillus subtilis spores. In addition to disinfecting water, reduction in UV light absorption shows that the treatment disintegrates organic material. The researchers observed complete inactivation of the spores at various flow rates, demonstrating the potential of Pulsed UV Light as a reliable method for water disinfection. The study also highlighted that Pulsed UV Light treatment required less energy compared to other methods.

The researchers concluded that Pulsed UV Light treatment shows promise for water disinfection applications and further optimization of the system, including testing at higher flow rates, would be beneficial.

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