Collaborative university study shows Pulsed Light is a sustainable and effective method to maintain municipal wastewater

Overview

In a collaboration between Pennsylvania State University and Firat University in Türkiye, researchers have demonstrated that flow-through pulsed UV-light treatment can enhance wastewater quality and keep us safer from contamination.

Microbial inactivation experiments were carried out in a laboratory flow-through system with a XENON Pulsed Light sterilization system consisting of a controller, chamber, lamp, and power supply. Results show the system was effective in inactivating microorganisms, including E. coli and B. subtilis, in municipal wastewater effluent. Pulsed Light can be developed into an effective and sustainable method for disinfecting and improving the quality of municipal wastewater.

Markets/Applications

- Municipal wastewater treatment: Enhance the disinfection process and improve the quality of treated wastewater.
- Industrial wastewater treatment: Disinfect and treat industrial wastewater before discharge, reducing its environmental impact.
- Water reuse systems: Recycle wastewater for non-potable applications like irrigation, industrial processes, or toilet flushing.
- Environmental remediation: Disinfection and restoration of polluted bodies of water, helping to protect ecosystems and maintain water quality.
- Developing countries and remote areas: Wastewater disinfection in regions with limited access to traditional treatment infrastructure, improving sanitation and public health.

Highlights

- Pulsed Light treatment achieved significant reductions in COD, TOC, SS, and turbidity for E. coli in synthetic municipal wastewater effluent
- An environmentally friendly disinfection method as it does not produce hazardous by-products and operates without the use of mercury for safe and sustainable treatment.
- A versatile treatment that can be used in many settings including municipal wastewater treatment and various liquid waste streams.
- Flow-through pulsed UV-light treatment performed better than other disinfection methods such as chlorine.
- Pulsed Light offers higher microbial inactivation rates and improved water quality.

Pulsed Light can be developed into an effective and sustainable method for disinfecting and improving the quality of municipal wastewater.

The information in this report was prepared by XENON and does not contain the complete research conducted by Uslu et al. A full version of the research paper is available at https://www.sciencedirect.com/science/article/abs/pii/S2214714416300575

Summary of Research

Disinfection of synthetic and real municipal wastewater effluent by flow-through pulsed UV-light treatment system

Original research by Gulsad Uslu, Ali Demirci, John M. Regan

Objective: Investigate the effectiveness of flow-through Pulsed Light treatment for microorganism inactivation in municipal wastewater effluent.

Methodology: Researchers used a XENON laboratory flow-through Pulsed Light treatment system to investigate the inactivation of microorganisms in synthetic and real municipal wastewater effluent. The experimental setup involved passing the wastewater through a chamber equipped with UV lamps that emitted short bursts of intense UV light. The treatment process was conducted at different flow rates to vary the exposure time of the wastewater in the chamber.

To evaluate the effectiveness of the pulsed UV treatment, researchers measured parameters including chemical oxygen demand (COD), total organic carbon (TOC), suspended solids (SS), and turbidity. The reductions in these contaminants were assessed to determine the efficiency of the treatment in removing pollutants from the wastewater. Additionally, the study investigated the impact of different factors such as flow rate and initial COD concentration on the inactivation of microorganisms.

Temperature profiles during the treatment process were monitored to assess any temperature changes resulting from the pulsed UV-light exposure. Researchers examined the cumulative energy input and its relationship with temperature variations. Photo-reactivation experiments were further conducted to evaluate the repair mechanisms of microorganisms after UV exposure. They performed dark and light repair experiments, followed by incubation under different conditions to determine the extent of microbial inactivation.

Results and Conclusions: The results demonstrated the effectiveness of flow-through pulsed UV-light treatment in the inactivation of microorganisms in municipal wastewater effluent. Significant reductions were observed in parameters such as COD, TOC, suspended solids, and turbidity, indicating the removal of pollutants from the wastewater. Research concluded that flow-through pulsed UV-light treatment has great potential as an alternative method for disinfecting wastewater, with advantages such as shorter treatment times, lower energy requirements, and environmental friendliness.

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